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A USERS MANUAL FOR COMPUTERIZATION OF HYDROGEOLOGIC DATA FOR A RIVER ALLUVIUM

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A USERS MANUAL FOR COMPUTERIZATION OF HYDROGEOLOGIC DATA FOR A RIVER ALLUVIUM

By James W. Naney, Bill B. Barnes, and Douglas C. Kent[1]

ABSTRACT

A system for rapid storage and retrieval of data from a multilayered aquifer based on the hydraulic properties of the aquifer was developed. The manual consists of the data-retrieval system, control-card setups and specifications, lists of variables, formats and source listings for data storage and retrieval, and graphical illustrations demonstrating how the system works. Data for the examples were collected in the alluvium of the Washita River near Chickasha, Okla. These data were processed according to the manual to produce a lithologic cross section, an isopachous map, a specific subdatum map, a distributed test-hole-data map, and a permeability-distribution map. The system proved capable of storing and retrieving a large volume of layered hydrogeologic data, and it will have wide geographic application where hydrogeologic studies are undertaken. The system may also be adapted to other types of materials because it uses numerical coding exclusively to describe the hydrogeologic data to be stored, retrieved, and manipulated. **KEYWORDS: computerization of hydrogeologic data, ground water, ground-water storage, ground-water transmissibility, hydrogeology, hydrology, lithology, soil permeability.**

INTRODUCTION

A layered lithologic system created the need for specialized computer programs to store, retrieve, and manipulate hydrogeologic data. Existing programs (*1, 5, 7*)[2] would store data on labeled punched cards or provide for the alphameric coding of data on punched cards and store and retrieve ground-water hydrographs. This manual, however, has been developed for the selection and retrieval of ground-water data based on the hydraulic properties of an alluvial aquifer. It documents techniques described in an earlier paper by Kent et al. (*3*); excerpts from that paper are included here for convenience.

The retrieval system was applied to define boundaries and internal hydraulic characteristics of an aquifer in the Washita River alluvium near Chickasha, Okla. (fig. 1). The alluvium is characterized by several discontinuous layers of silty clay, sand, and gravel similar to those found in stratified alluvial fans, as well as some stratified basin and Coastal Plain sediments. Although the approach used in this study was specifically designed for alluvial aquifer systems, as shown by Naney and Kent (*6*), it can be used for other similar aquifers.

The computer codes presented in this manual are written in FORTRAN IV for the IBM 360–65 computer. Some of the techniques used for processing the data in the examples were developed on the IBM 1130. A restriction on the word length for coding some of the data was

[1] Geologist and computer specialist, Agricultural Research Service, U.S. Department of Agriculture, Chickasha, Okla. 73018, and associate professor of geology, Oklahoma State University, Stillwater, Okla. 74074.

[2] Italic numbers in parentheses refer to items in "Literature Cited" preceding appendix A.

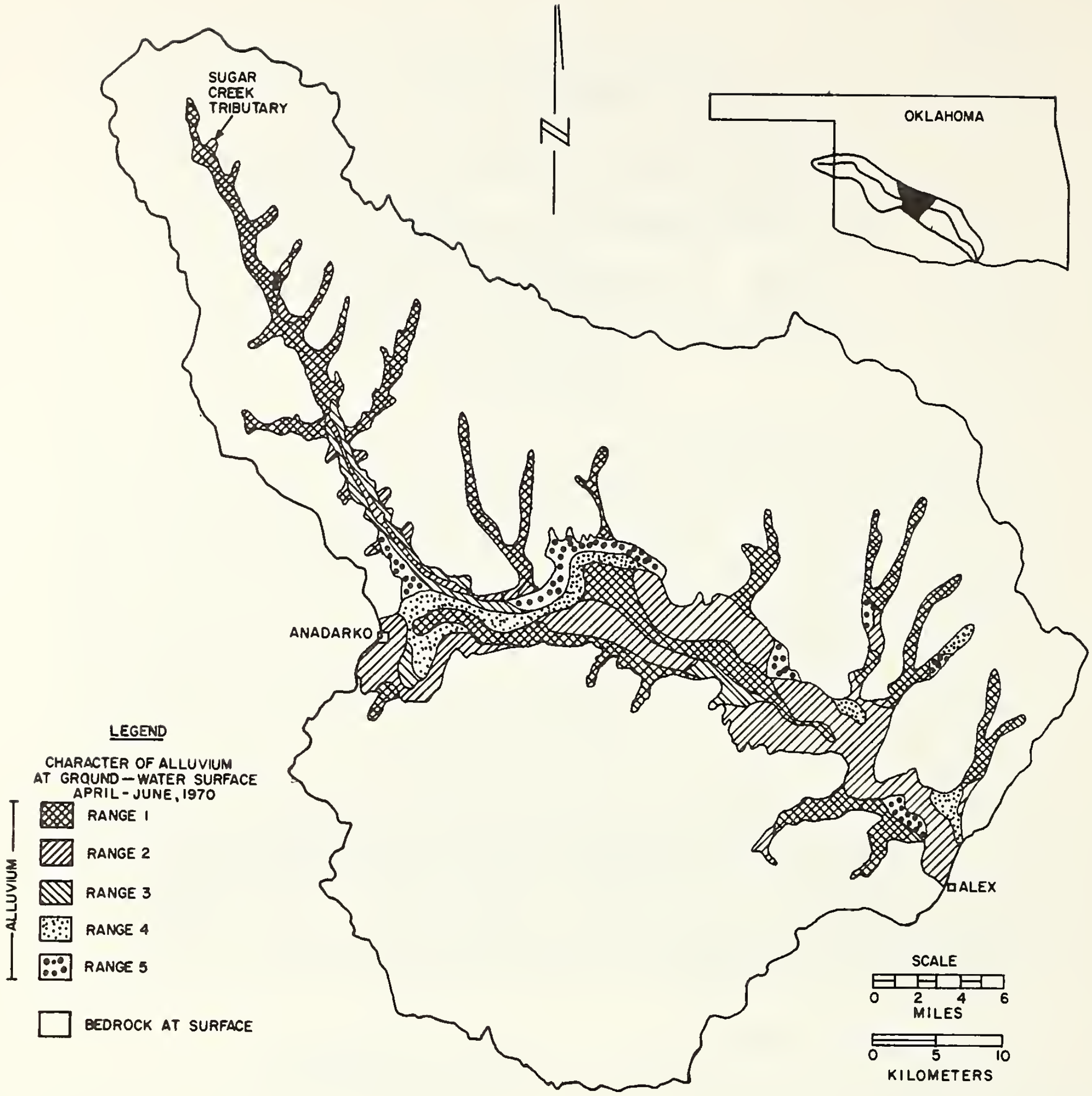


FIGURE 1.—Hydraulic-coefficient ranges in the Washita River alluvium.

encountered with the IBM 1130. The adaption of these programs to both computers, however, has expanded the availability of the technique for which this manual is written.

Three types of data are documented and stored in this data-handling system: (1) general test-hole information (test-hole data); (2) stratification characteristics (layer data); and (3) water-level records (water-level data). The test-hole data consist of the well number, location, elevation of ground surface, elevation of top of pipe (well casing), the number of layers, and the method of drilling. Layer data include layer number and thickness, method of analysis, lithologic type and color, and approximate range of the hydraulic coefficient for each layer. The water-level data include well number, record type, date, time, and water-level elevation.

DATA-RETRIEVAL SYSTEM

The data-retrieval system (fig. 2) is based on descriptions of the lithology in terms of the type and color of material and of the hydraulic properties associated with each layer. These descriptions are stored by test-hole number, latitude and longitude, and layer number on a disk or magnetic tape. General test-hole information and water-level records are stored

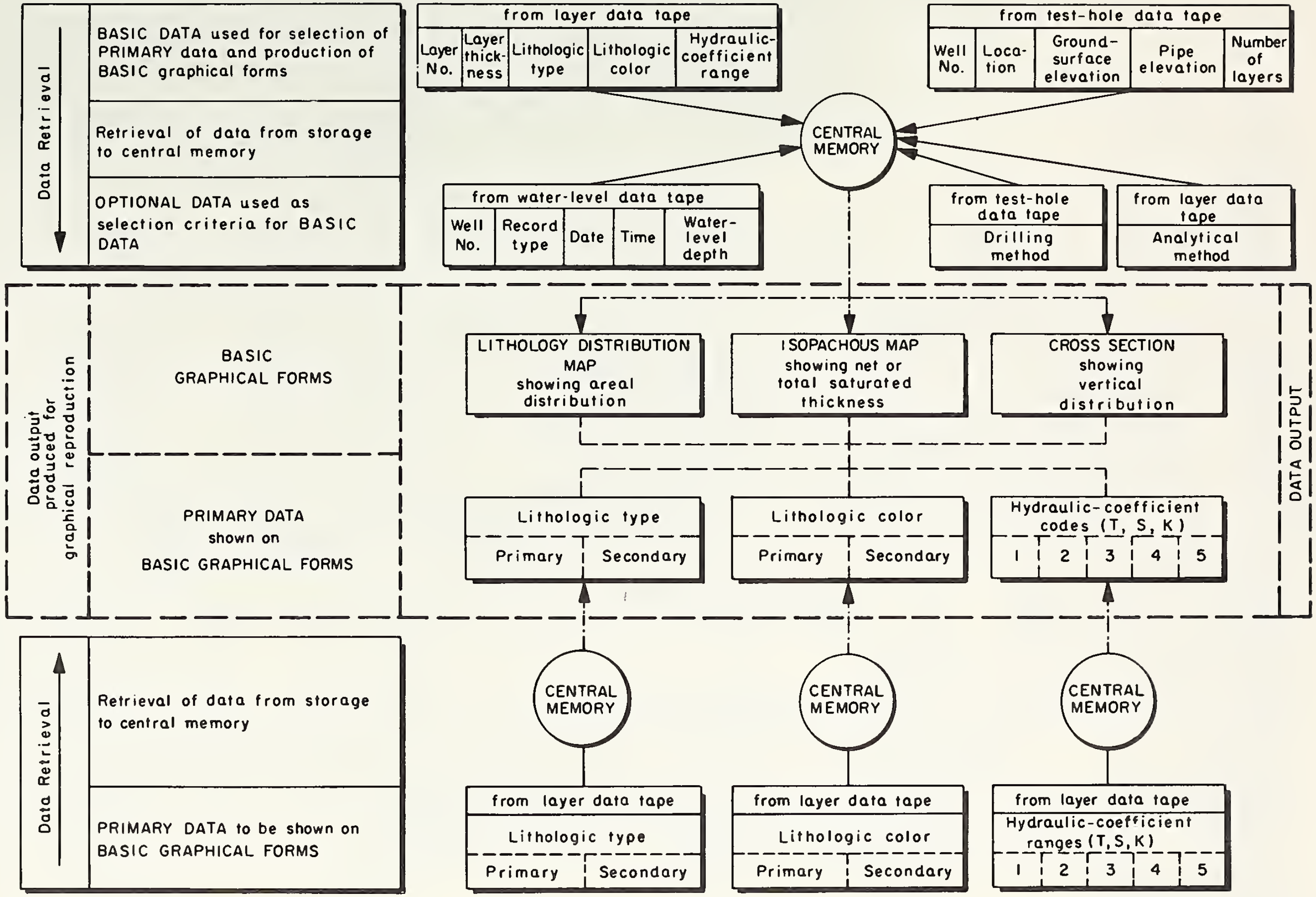


FIGURE 2.—Type and function of data processed in computer storage and retrieval system.

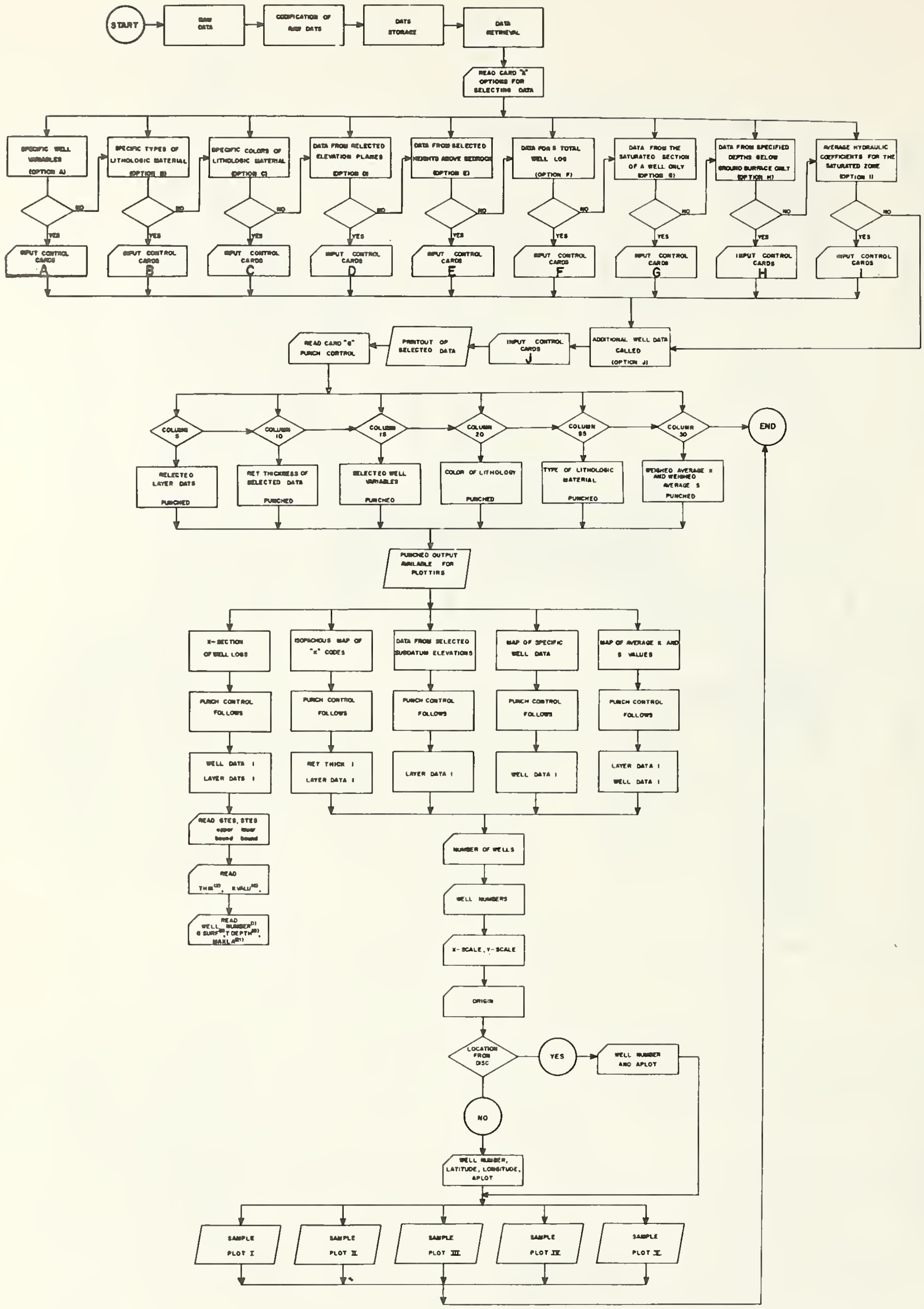


FIGURE 3.—Flow chart for retrieval of hydrogeologic data.

by well number and location on separate disks or magnetic tapes. Specific information related to each of these data is numerically coded and stored by variable number. Combinations of these stored data are used as criteria in the selection of other data or as data that are to be shown graphically.

The hydraulic characteristics of a multilayered aquifer system can be evaluated by options that allow selective retrieval of data. Ten options for data selection and comparison are specified on control cards. A general flow chart of the retrieval program is shown in figure 3. Figure 4 shows how each specific option is selected. Control-card layouts for retrieval options A through J and a description of card types A through N appear in appendix A. The variable name and columns assigned to each code are shown for each option. A list of variable names with descriptions also appears in appendix A. In addition to the options described, subroutine packages may be introduced to be called by specified control cards.

Data-storage format.—The data-storage program reads data from punched cards in the formats shown in appendix B and stores them on magnetic tape. Twenty-one variables are stored for each test hole, including variables that describe the entire well, such as the type of well casing or the elevation of the top of the pipe. These variables are presented in table 1.

Twenty lithologic zones or layers are allowed for each test hole. Currently, no more than 14 distinguishable layers have been stored for any one test hole. There are eight variables describing the lithologic characteristics of each layer, such as layer thickness or the type of material. These variables (table 1) are read from punched cards according to the format shown in appendix B and stored on magnetic tape.

Ground-water levels are stored on magnetic tape for use in conjunction with the test-hole and lithologic-layer data. The format used on punched cards to store the data is shown in appendix B. Storage and retrieval programs for test-hole, layer, and water-level data, along with comments and execution cards, appear in appendix C. The three basic graphical forms produced are test-hole cross sections, lithology-distribution maps, and isopachous maps. A separate retrieval program (not shown in figure 2) provides data for maps that show the distribution and change in level of the ground-water surface.

Coding and storage of lithologic data.—The lithologic type and color are described with unique combinations of numbers (table 2). Only five numbers representing grain size are used in the code to describe the lithologic type because

TABLE 1.—*Data-processing code for tape storage, entire well*

Variable	Term	Code form[1]
1	Well number or test-hole number	XXXX
2	Watershed number	XXX
3	Location (latitude: degrees, minutes, seconds)	XX XX XX
4	Location (longitude: degrees, minutes, seconds)	XX XX XX
5	Top of pipe elevation	XXXX.XX
6	Ground-surface elevation	XXXX.XX
7	Bedrock elevation	XXXX.XX
8	Total depth of test-hole log (ft)	XXX
9	Distance from logged well to observation well (ft)	XXXXXX
10	Total depth of observation well (ft)	XXX
11	Drilling method	X
	Core	1
	Rotary	2
	Split spoon	3
	Auger	4
12	Casing type	X
	Metal	1
	Plastic	2
13	Casing length (ft)	XXX
14	Casing diameter (in)	XX.XX
15	Screen	XXX.XX
	Screen length (ft)	XX.XX
	Screen diameter (in)	XXX.XX
16	Pump type	X
	Submersible	1
	Jet	2
	Turbine	3
	Centrifugal	4
17	Pump use	X
	Domestic	1
	Irrigation	2
	Experimental	3
18	Pump capacity (gal/min)	XXXX
19	Number of stages	XX
20	Pump diameter (in)	XX.X
21	Number of layers	XX

[1] An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable. For example, a 4 put in the space designated by the X after "drilling method" would only select wells drilled by an auger.

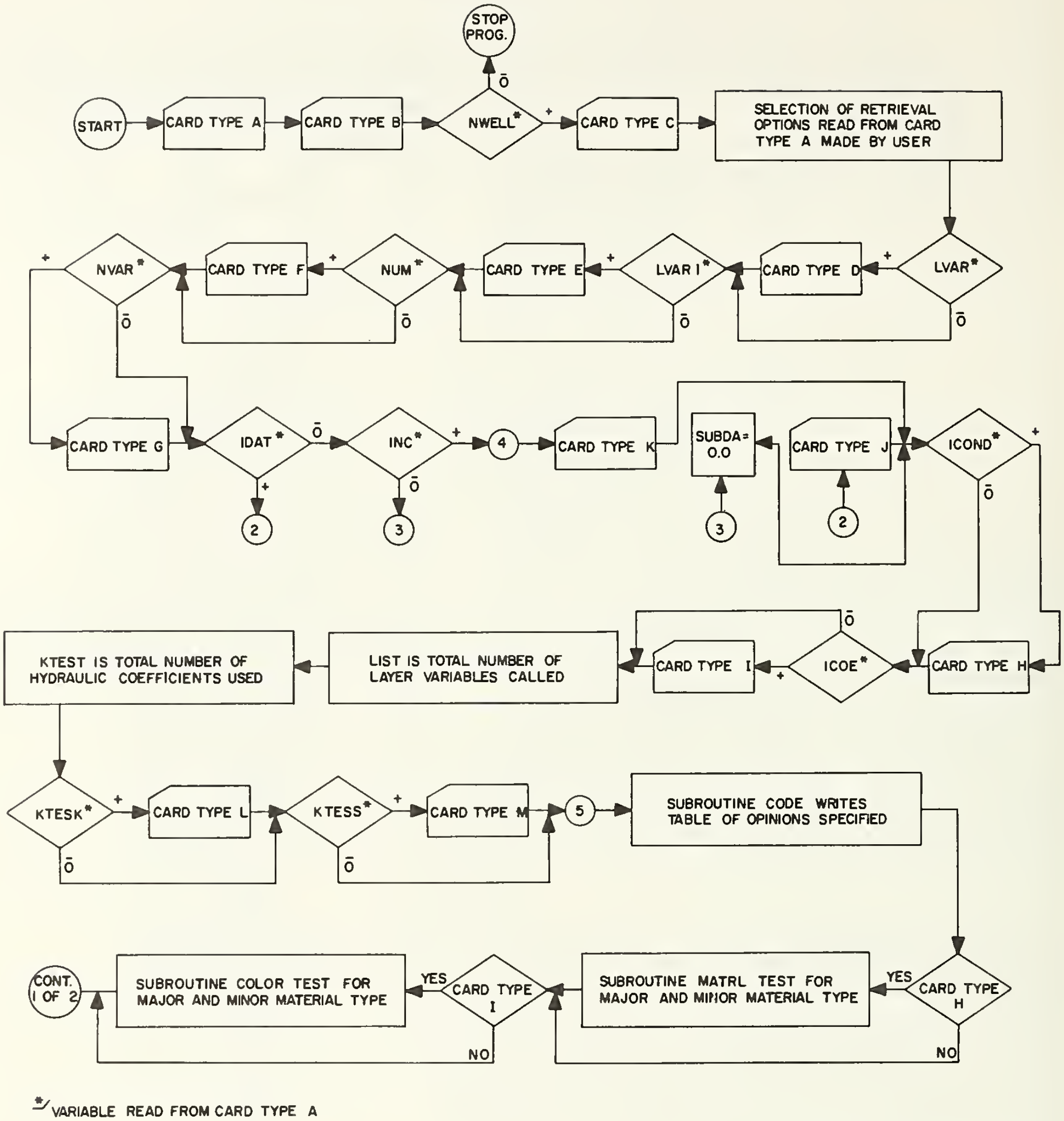
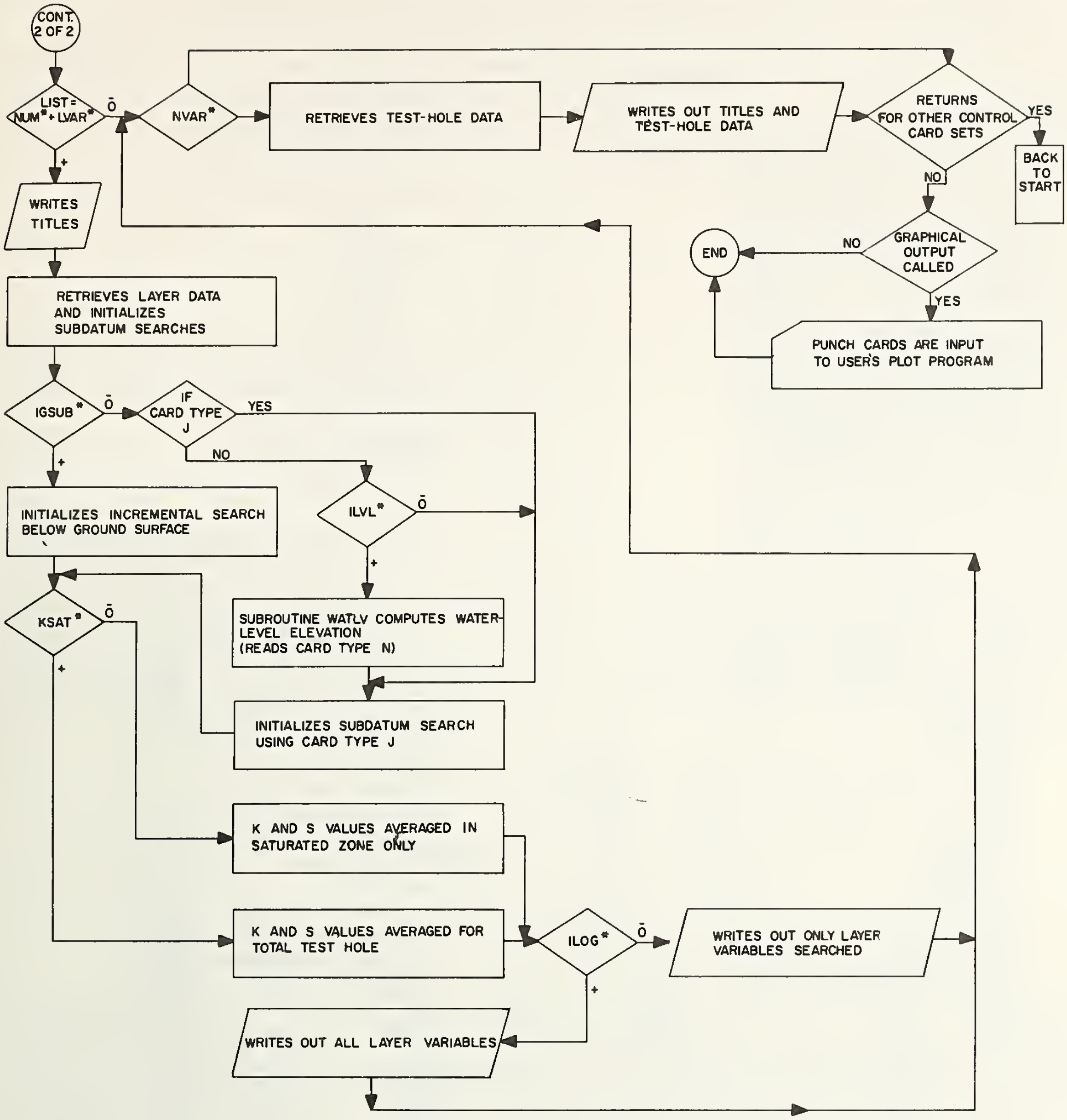


FIGURE 4.—Flow chart for

of computer storage limitations. The codes are stored by lithologic layer in the computer. Two primary or one primary and one secondary constituent describe each lithologic layer. These data are also reduced to a form that can show the hydraulic properties (coefficients) of the aquifer.

The lithologic type and color are based on log descriptions made in the field. These logs need to be interpreted accurately before the data can be standardized and stored as layer data. For analytical interpretation of test-hole logs, samples are taken from holes cored adjacent to formerly drilled test sites. Grain size of each core sample is visually described and analyzed for comparison with descriptions based on drill cuttings. The median grain size is equivalent to the grain size having the highest percentage of occurrence in the drill-cutting sample and is termed "primary constitutent." A grain size representing a smaller percentage of the sample is labeled "secondary constituent." With these comparisons and terms, quantitative relationships can be transposed into



retrieval control cards, A–N.

terms for coding the visual description of drill cuttings.

Hydraulic properties of the aquifer are determined by using a relationship between grain size and the hydraulic coefficients (fig. 5). The hydraulic coefficients (the coefficients of permeability and storage) are based on field-pump tests of selected alluvial material, laboratory tests of the core samples, and grain size-specific yield relationships (*2*). The hydraulic properties are coded by dividing the primary and secondary grain sizes into four identifiable ranges (table 3). Undifferentiated sand is included in a fifth range.

A computer program (appendix D) is used to assign a range number (1–5) to the layers of each well on the basis of the coded lithologic description shown in table 4. Hydraulic-coefficient values representing these ranges can be arbitrarily selected from a graphical relationship similar to the one shown in figure 5. The grouping technique makes them applicable to all drill-log data, with only the values represented by each code being subject to change

TABLE 2.—*Data-processing code for tape storage, stratigraphic layers*

Variable	Term	Code form[1]
1	Layer number	XX
2	Layer thickness	XX
3	Type of material:[2] *column 1*, number of primary constituents (zero if unknown); *column 2*, code of primary constituent; *column 3*, code of adjective for primary constituent (zero if primary constituent has no adjective); *column 4*, numeral 1 if second primary constituent or secondary constituent has no adjective (zero if no secondary constituent), or code of secondary constituent if it has an adjective, or code of second primary constituent with adjective; *column 5*, code of second primary constituent with no adjective or secondary constituent with no adjective (zero if no second primary constituent or secondary constituent exists), or code of adjective for secondary constituent, or code of adjective for second primary constituent.	XXXXX
	Constituents	X
	Clay	0
	Silt	1
	Sand	2
	Gravel	3
	Sandstone	4
	Carbonate	5
	Shale	6
	Evaporite	7
	Undifferentiated alluvium	8
	Undifferentiated bedrock	9
3	Type of material—Continued:[2]	
	Log-description adjective	X
	Very fine	2
	Fine	3
	Medium	4
	Coarse	5
	Lime	6
	Dolomite	7
	Halite	8
	Fossiliferous	9
4	Color of material: major color is the left digit, minor color the right digit (a zero in either place indicates no color).[3]	XX
5	Analytical method	X
	Visual accumulation tube	1
	Sieve	2
	Driller inspection (field)	3
	Microscopic examination	4
	HYDRAULIC COEFFICIENTS[4]	
6	Transmissibility (*T*) (gpd/ft)	X
	Values from 0 to 8,000	1
	Values from 8,000 to 30,000	2
	Values from 30,000 to 80,000	3
	Values from 80,000 to 150,000	4
7	Permeability (*K*) (gpd/ft^2)	X
	Values from 0 to 80	1
	Values from 80 to 300	2
	Values from 300 to 800	3
	Values from 800 to 1,500	4
8	Storage coefficient (*S*) (dimensionless ratio)	X
	Values from 0.0000 to 0.0001	1
	Values from 0.0001 to 0.0009	2
	Values from 0.0009 to 0.0020	3
	Values from 0.0020 to 0.0040	4

[1] An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable.

[2] For example, a log description of a primary and a secondary constituent as "medium sand, with some fine sand" results in a code name of "sand, medium, with some sand, fine," or a number code of 12423. Again, a log description of two primary constituents as "medium sand, and fine sand" results in a code name of "sand, medium, and sand, fine," or a number code of 22423.

[3] For example, a sample with a major color of red but no minor color would be coded 20, one with no major color but a minor color of red, 02; a sample with a major color of red and a minor color of brown would be coded 25, one with a major color of brown and a minor color of red, 52. A code of 00 indicates no color at all was recorded.

[4] Code numbers 1–4 represent a range of values for *T*, *K*, and *S*.

based upon the geological materials being investigated.

Retrieval of lithologic data.—Data can be retrieved in many forms, but the most useful are cross sections and maps that define aquifer boundaries and the horizontal or vertical distribution of the hydraulic properties in the aquifer. The schematic diagram of the retrieval system (fig. 6) shows the assignment and use of the ranges and corresponding estimated values of the hydraulic coefficients for presentation in different graphical forms. Retrieval and testing of test-hole, layer, and water-level data are essential to provide information necessary for selection and plotting of specified ranges of the hydraulic coefficients (fig. 2). Retrieval of test-hole data provides information necessary for selection and plotting of the ranges at a specified depth or subdatum elevation. Water-level data are used to select ranges characteristic of each layer within the saturated zone. Testing on the range number of the hydraulic coefficient permits the selection of specified ranges of the hydraulic coefficients.

TABLE 3.—*Lithologic type and associated range of the hydraulic coefficients*

Range[1]	Lithologic description of log[2]
1	Silt;[3] silt with some very fine sand; very fine sand with some silt; silt and very fine sand.
2	Very fine sand; very fine sand with some fine sand; fine sand with some very fine sand; very fine sand and fine sand.
3	Fine sand; fine sand with some medium sand; medium sand with some fine sand; fine and medium sand.
4	Medium sand; coarse sand and gravel; medium sand with some coarse sand and gravel; coarse sand and gravel with some medium sand; medium and coarse sand.
5	Undifferentiated material in ranges 2, 3, and 4.

[1] Zero is used when a range cannot be assigned to a layer.

[2] Combination of primary and secondary constituents that are classified as indicated.

[3] Silt and clay are undifferentiated.

TABLE 4.—*List of codes representing four groups of relative permeability*

Clay and silt (1)		Sand: Very fine to fine (2)		Sand: Fine to medium (3)		Sand: Medium to coarse (4)	
10000	20011	12211	22211	12324	22324	12500	22524
10011	20012	12311	22311	12423	22423	12524	22425
10012	20013	12011	21122	12300		12425	23125
10013		11122	21123	12400		13000	23124
	20017	11123	22223	12413		13012	22513
10017	20019	12200	22322			13125	
10019	23010	12300				13124	
10125	21010	12223				12513	
10124	21012	12322					
10123	21013						
10122							
12210							
12310							
12410							
12510							
12010							
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11012							
11013							
11017							
11019							
13011							
16000							

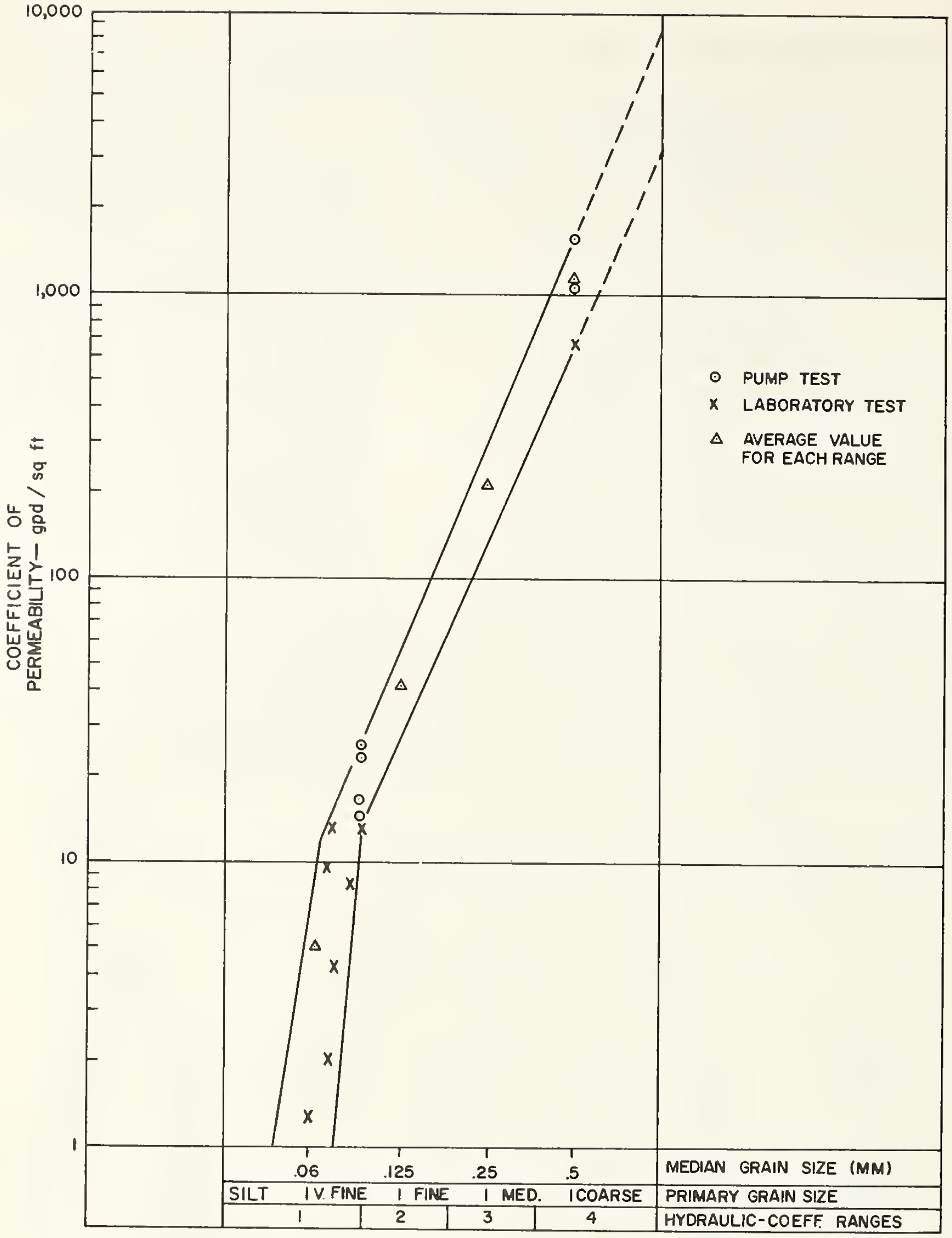


FIGURE 5.—Relationship between hydraulic-coefficient ranges, median grain size, and the coefficient of permeability.

One important aspect of the retrieval system is the use of water-level records for selecting data in the saturated zone. A subroutine which computes a weighted average of all measurements within a selected time period is used to determine the average elevation of the groundwater surface in each well.

GRAPHICAL PRESENTATIONS

Examples are given of five basic types of graphical presentations of data retrieved. One cross-section display and four possible map-view displays are shown. A flow chart of the steps followed in preparing graphical displays and the list of variable names, with descriptions, used to plot selected data are shown in appendix E.

Cross sections of drill-hole logs.—Drill-hole data are punched on cards and may be used as input data for plotter programs. The control-card setup required to retrieve data for the plotting of cross sections is shown in figure 7.

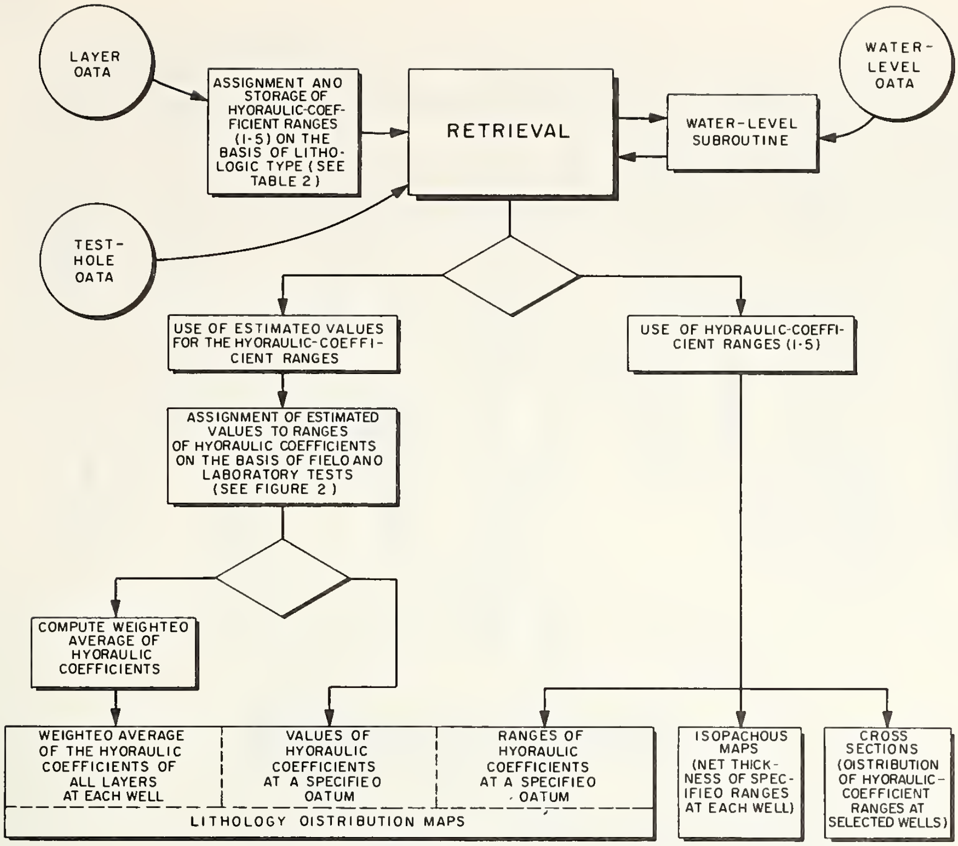


FIGURE 6.—Data-retrieval system using hydraulic coefficients.

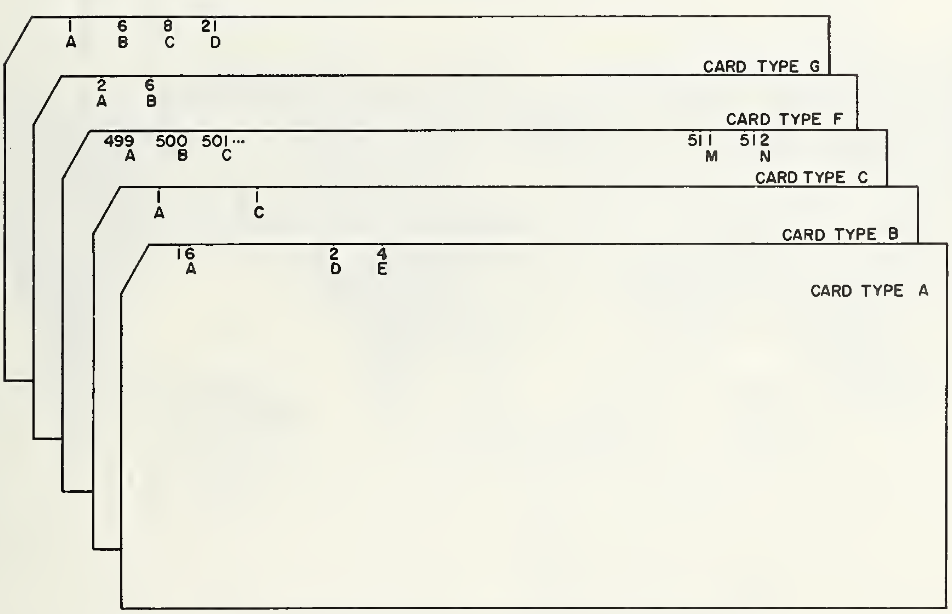
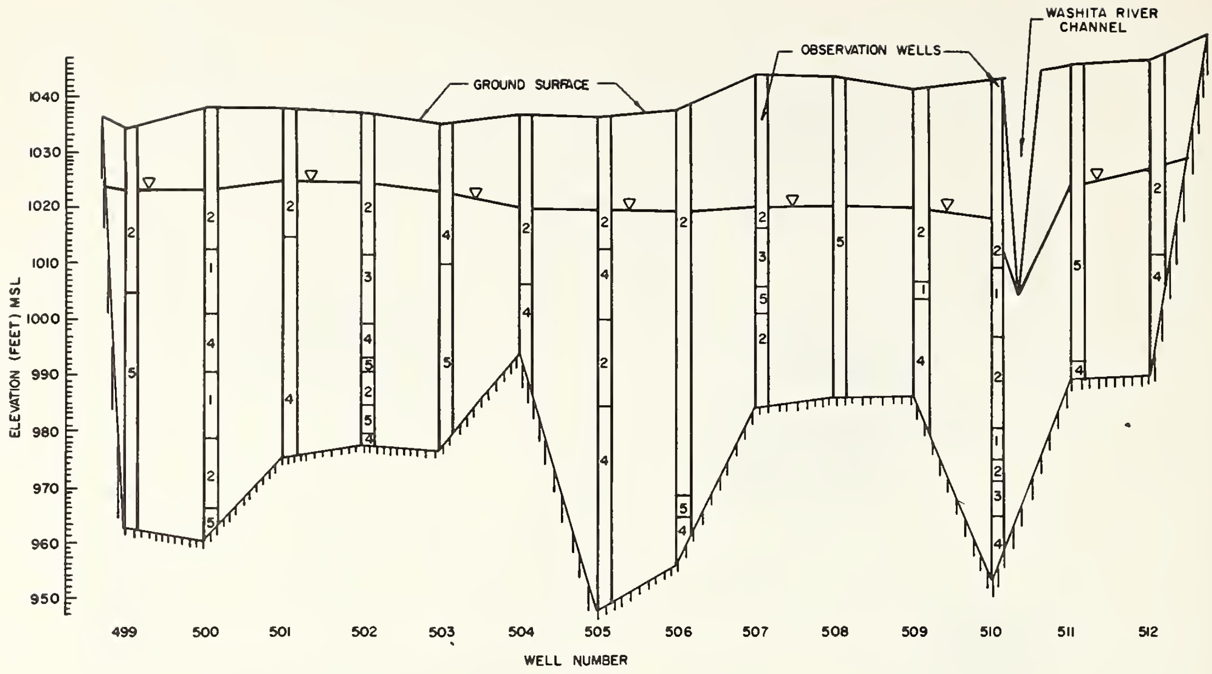
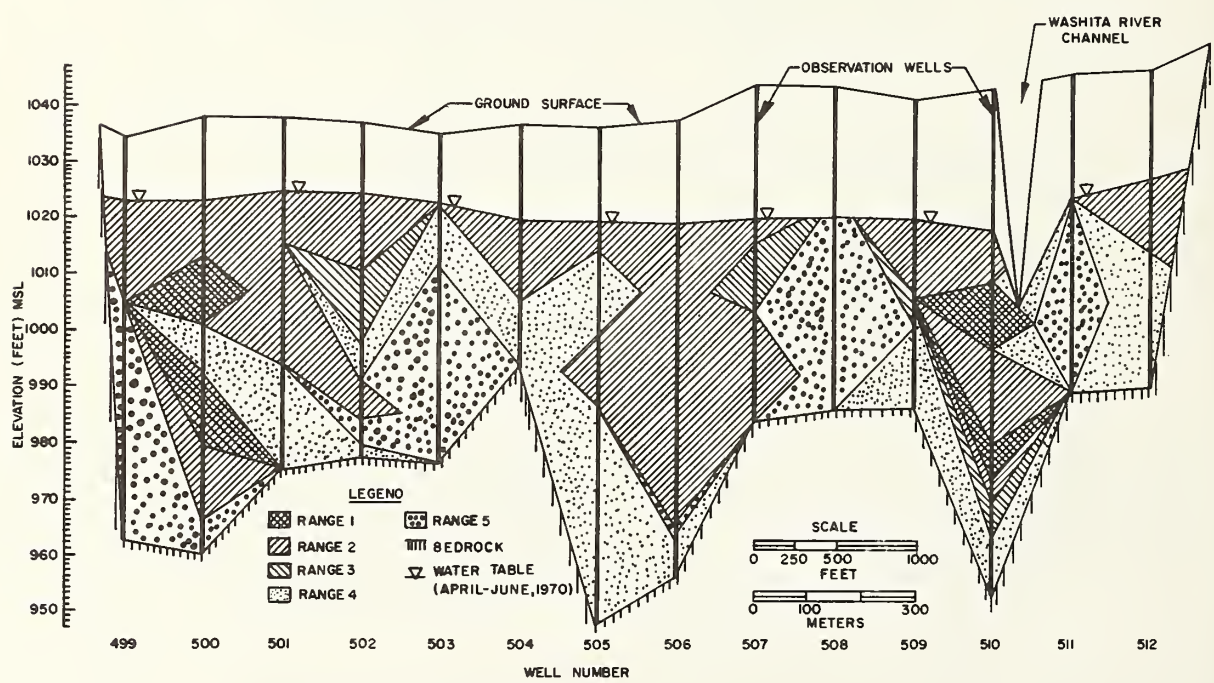


FIGURE 7.—Control cards for retrieval of data for plotting cross sections.



COMPUTER PLOT OF PERMEABILITY RANGES



INTERPRETED CROSS SECTION FROM COMPUTER PLOT

FIGURE 8.—Cross section near Alex, Okla.

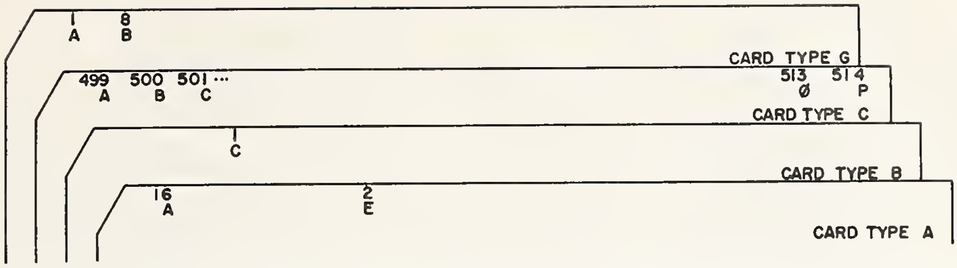


FIGURE 9.—Control cards for retrieval of data for mapping distributions of selected hole data.

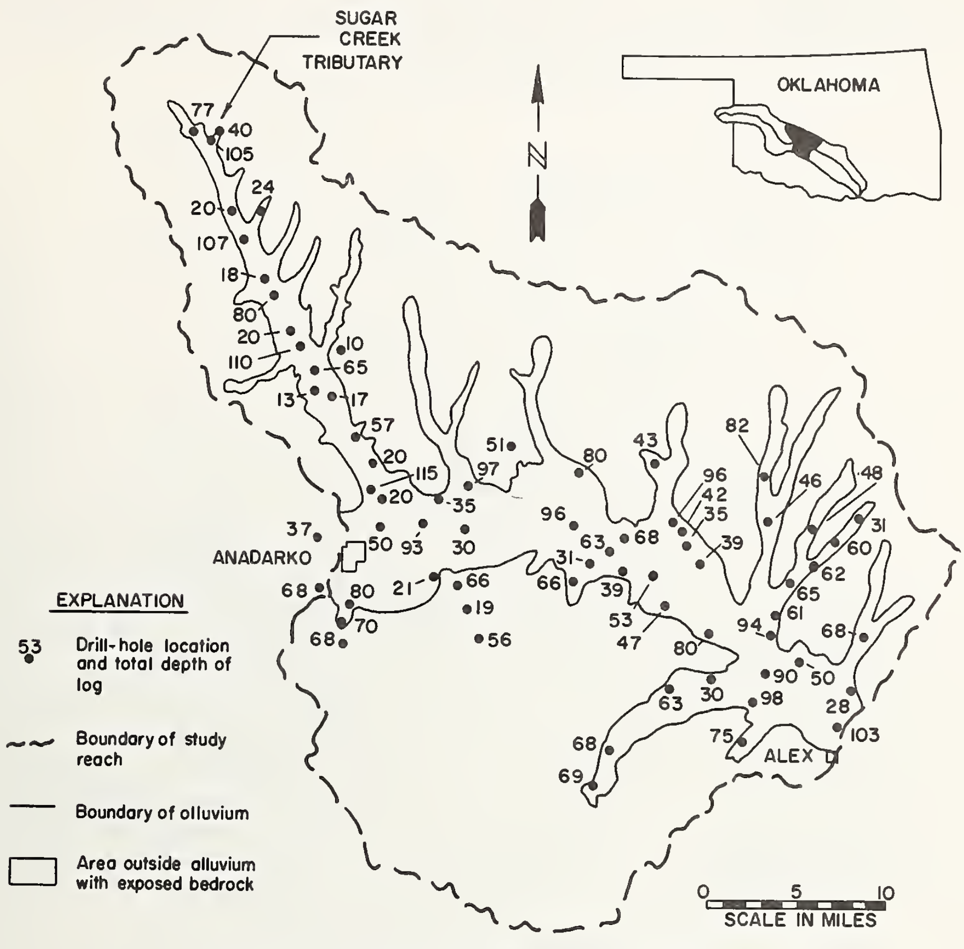


FIGURE 10.—Distribution of total depth of test holes.

For plotting options available, a description of each retrieval control card used is found in appendix A.

A plotted cross section of drill holes near Alex, Okla., is shown in figure 8. Appendix F shows the data cards used to plot cross sections. The variable name, type of plot, and column in which each variable is coded are shown for each card. These data may then be used on the plotting equipment available to the user.

Maps of distributed drill-hole data.—The total depths of the test holes were plotted as a distributive map. The control cards for the plotter program are listed in figure 9, and a map showing the distribution of the total depth of each test-hole log appears in figure 10. The map shows the depth to which lithologic data are available, since some test holes were not drilled to bedrock. Appendix F contains the data cards used to plot selected data maps, with

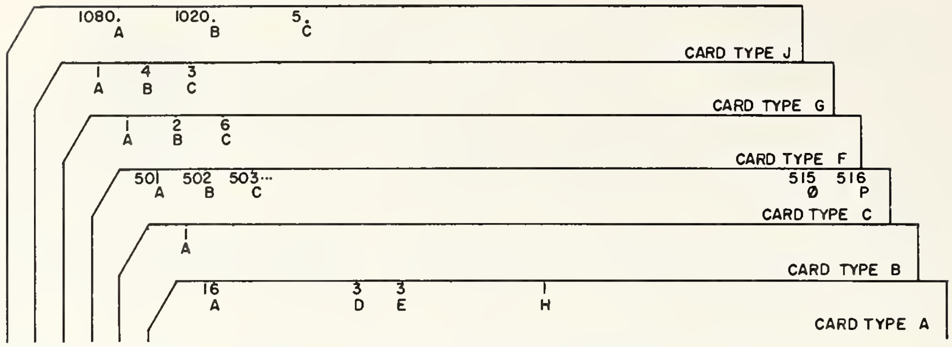


FIGURE 11.—Control cards for retrieval of hydraulic-coefficient ranges at a specified subdatum.

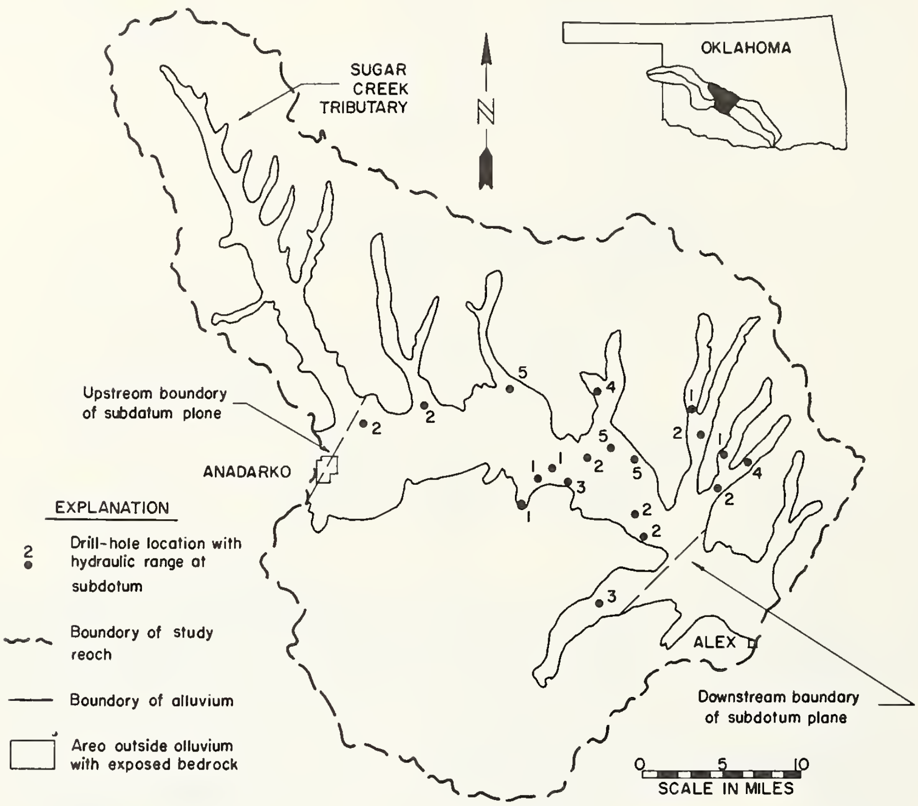


FIGURE 12.—Map of hydraulic ranges for a specified subdatum elevation.

the type of plot, variable name, and column containing the variable code indicated. Any of the 21 test-hole variables may be retrieved for plotting as a distributive map. Appendix E gives a list of variable names and their descriptions for all example plots.

Maps of data from specified elevations.—Because hydrogeologic data concern information that must be gathered at some depth below the surface of the ground, a convenient method of looking at various levels, or subdatum elevations, was developed by the authors. Digital computer techniques are used to develop a planar surface of lithologic data for a specified elevation above mean sea level. Figure 11 shows the control cards for the subdatum searching. A map of the test holes that have lithology with hydraulic coefficients ranging from 1 to 5 at the specified subdatum is presented in figure 12. Appendix F contains the data cards needed to plot the map shown in figure 12.

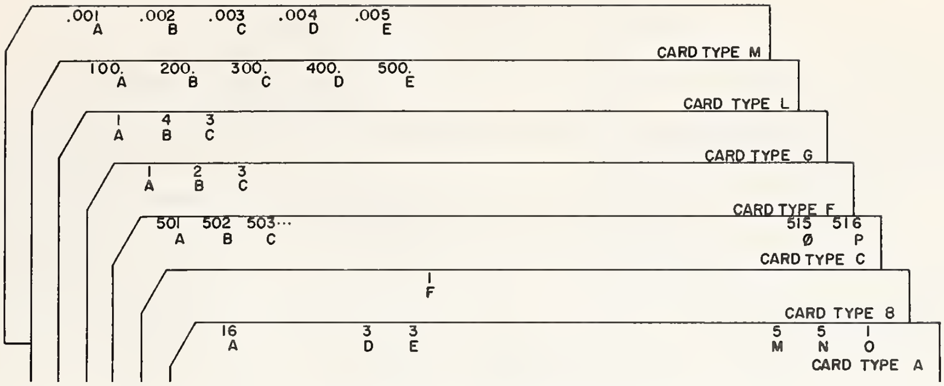


FIGURE 13.—Control cards for retrieval of weighted averages of the hydraulic coefficients of all layers in each hole.

FIGURE 14.—Map of average permeability coefficients.

Maps of average coefficients of permeability and storage.—When the ground-water flow through a specified cross section or the amount of ground water stored in a region of a watershed is needed, it is sometimes desirable to average the coefficients of permeability and storage of the layers that the test hole penetrates. Figure 13 shows the control cards for averaging these hydraulic parameters.

Those averaged values of K (permeability), when displayed in map view (as shown in figure 14), provide a distribution of test holes that are potentially high or low in ground-water yield. A distributive map of S (storage coefficient) may be produced using the system. It is possible to determine suitable well field locations and possible artificial recharge areas using areal maps (fig. 1) developed from the distributed test-hole data.

The retrieved data cards used to plot the map shown in figure 14 are presented in appendix F.

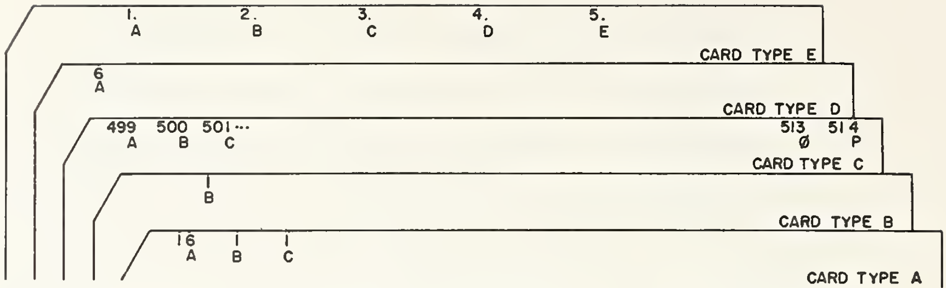


FIGURE 15.—Control cards for retrieval of an isopachous map of lithology having permeability ranges 1–5.

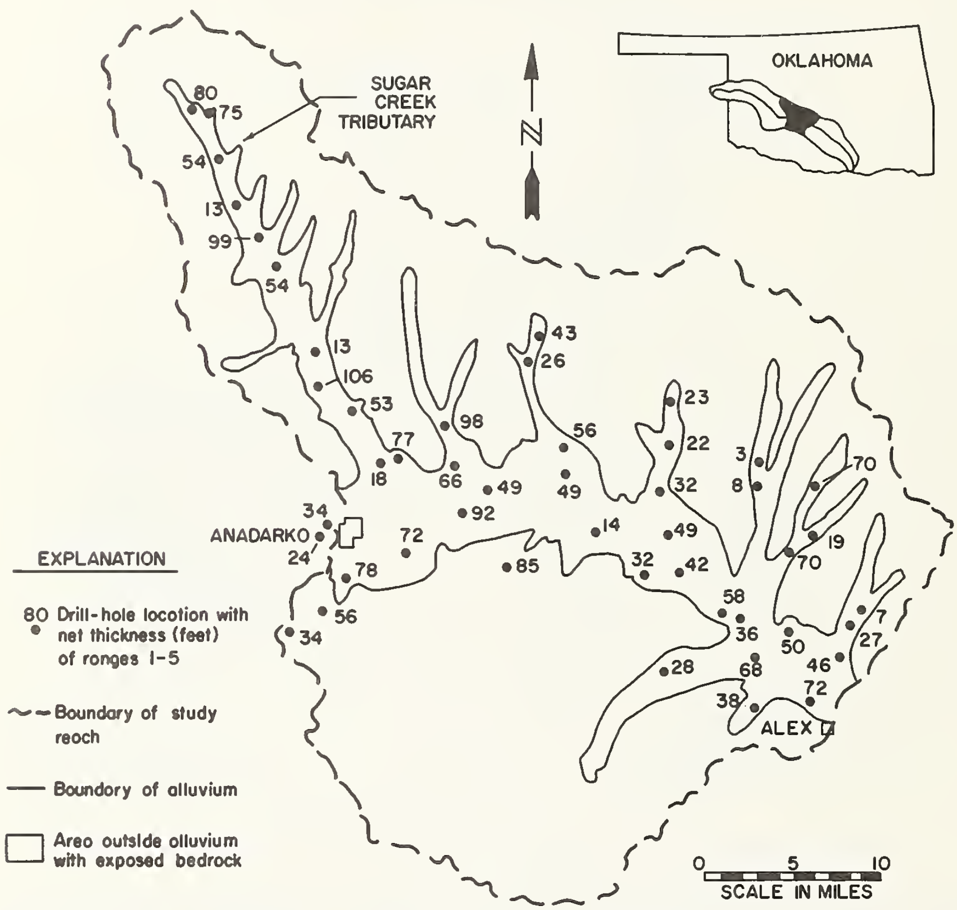


FIGURE 16.—Isopachous map of hydraulic properties, ranges 1–5.

Isopachous maps of specific hydraulic properties.—An isopachous map of all the lithologies within an alluvial system having the same hydraulic properties was also plotted. Such a map is used by planners when well fields are being installed or augmented. The amount of ground water available in an area may be determined from such a map (*3*).

A control-card setup for retrieving data for an isopachous map of all subsurface materials having a hydraulic code 1–5 is presented in figure 15. The isopachous map plotted is shown in figure 16.

Appendix F shows the retrieved data cards used to plot the map shown in figure 16.

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APPENDIX A.—CONTROL-CARD SETUPS, CARD SPECIFICATIONS, AND LIST OF VARIABLES FOR OPTIONS A–N

Control-Card Setups

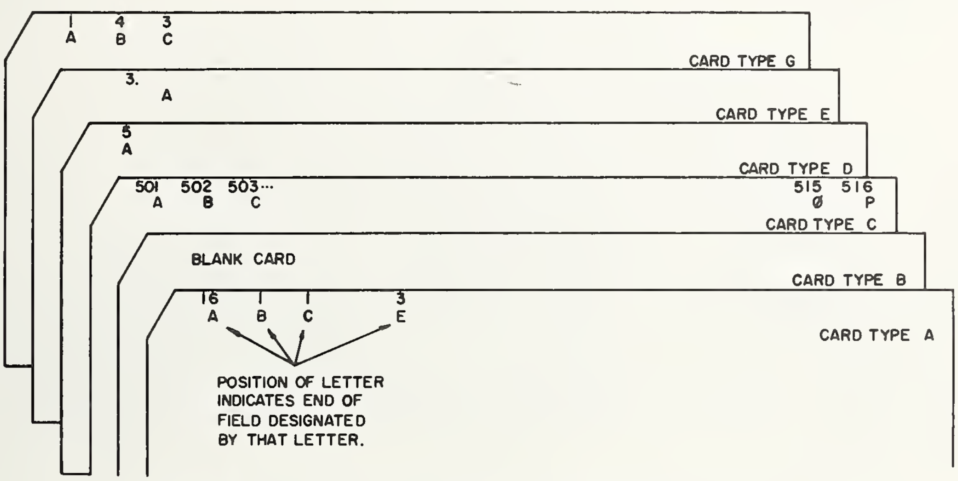

FIGURE A–1.—Retrieval option A: special drill-hole data.

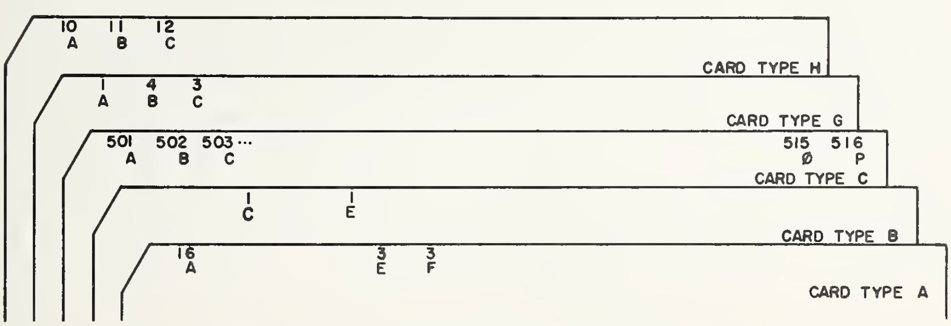

FIGURE A–2.—Retrieval option B: type of material.

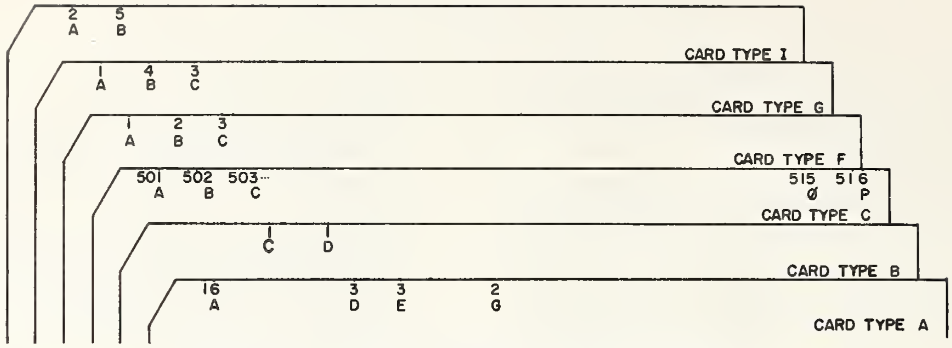

FIGURE A–3.—Retrieval option C: color of material.

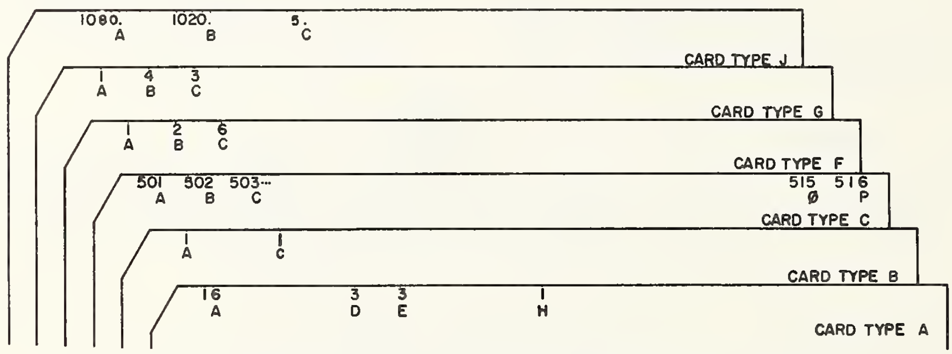

FIGURE A–4.—Retrieval option D: data from specified subdatum planes.

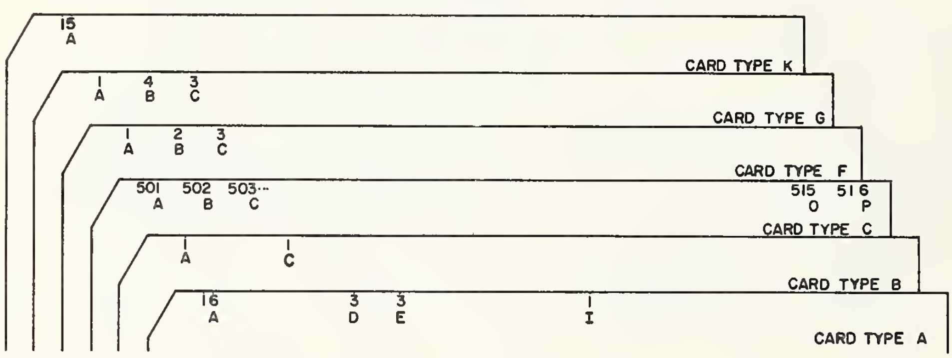

FIGURE A–5.—Retrieval option E: data from selected heights above bedrock.

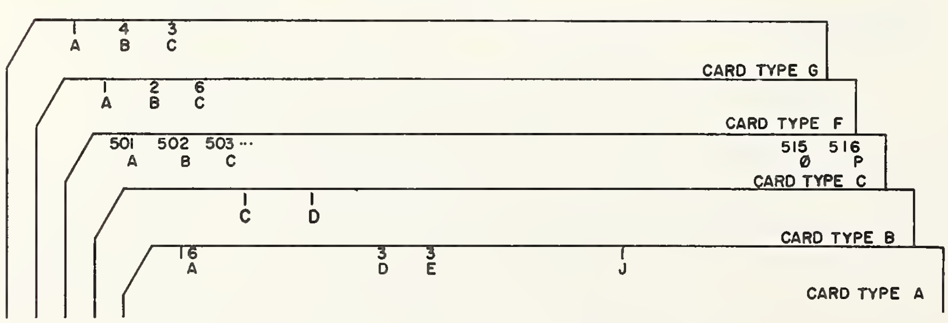

FIGURE A–6.—Retrieval option F: data for logging a test hole.

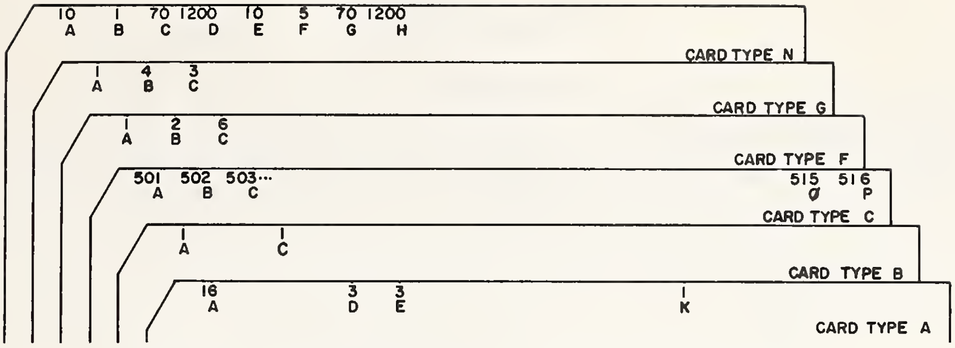

FIGURE A–7.—Retrieval option G: data from saturated zone.

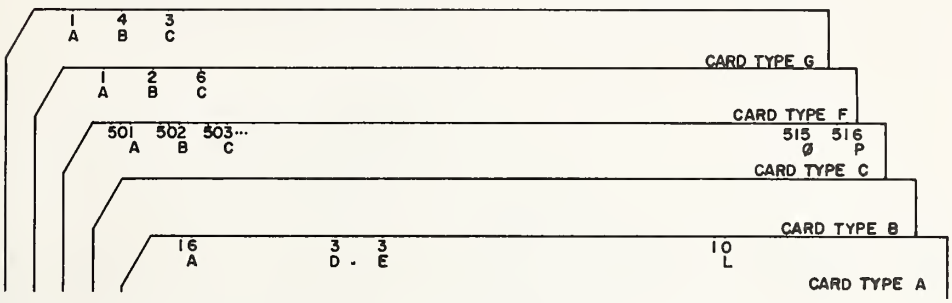

FIGURE A–8.—Retrieval option H: data from specified depths below ground surface.

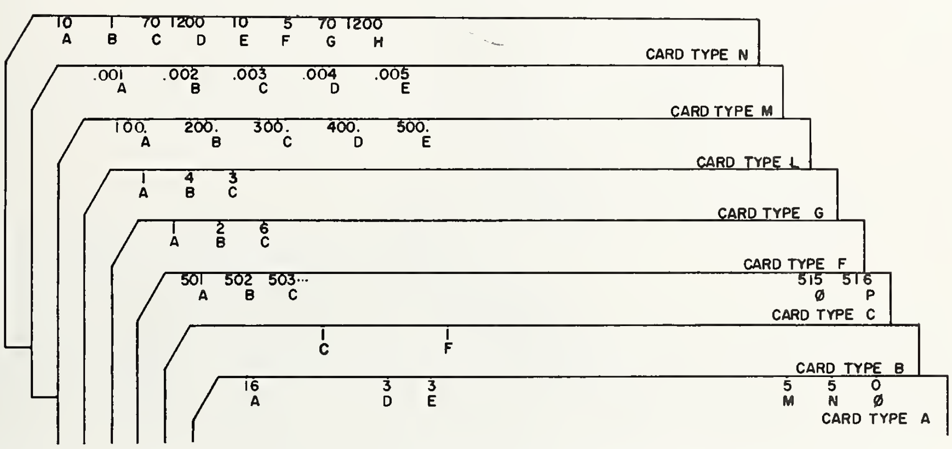

FIGURE A–9.—Retrieval option I: average hydraulic coefficients for the saturated zone.

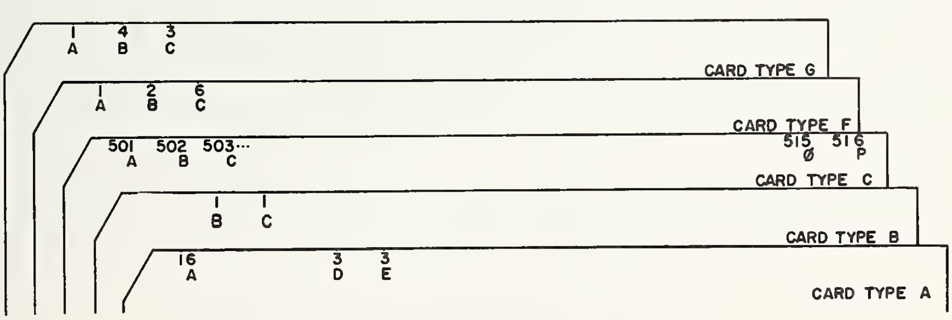

FIGURE A–10.—Retrieval option J: selection of all test-hole and layer data.

Card Specifications

CARD TYPE A

VARIABLE / OPTION (COLUMN)	NWELL 1-5	LVAR 6-10	LVAR1 11-15	NUM 16-20	NVAR 21-25	ICOND 26-30	ICOL 31-35	IDAT 36-40	INC 41-45	ILOG 46-50	ILVL 51-55	IGSUB 56-60	KTESK 61-65	KTESS 66-70	KSAT 71-75	
A	X	X	X		X											
B	X				X	X										
C	X			X	X		X									
D	X			X	X			X								
E	X			X	X				X							
F	X			X	X					X						
G	X			X	X						X					
H	X			X	X							X				
I	X			X	X								X	X	X	
J	X			X	X											

CARD TYPE B

VARIABLE / OPTION (COLUMN)	IPUNH(1) 1-5	IPUNH(2) 6-10	IPUNH(3) 11-15	IPUNH(4) 16-20	IPUNH(5) 21-25	IPUNH(6) 26-30
A						
B			X		X	
C			X	X		
D	X		X			
E	X		X			
F			X	X		
G	X		X			
H			X			
I			X			X
J			X			

CARD TYPE C

VARIABLE / OPTION (COLUMN)	IWELL(1) 1-5	IWELL(2) 6-10	IWELL(3) 11-15	IWELL(4) 16-20	IWELL(5) 21-25	IWELL(6) 26-30	IWELL(7) 31-35	IWELL(8) 36-40	IWELL(9) 41-45	IWELL(10) 46-50	IWELL(11) 51-55	IWELL(12) 56-60	IWELL(13) 61-65	IWELL(14) 66-70	IWELL(15) 71-75	IWELL(16) 76-80
A																
B																
C		CARD CONTAINS TEST-HOLE NUMBERS TO BE SEARCHED. MORE THAN ONE TYPE C CARD MAY BE USED FOR ANY OPTION. MAXIMUM OF 1,000 TEST HOLES MAY BE SEARCHED.														
D																
E																
F																
G																
H																
I																
J																

FIGURE A-11.—Description of card types A, B, and C.

CARD TYPE D

VARIABLE / OPTION \ COLUMN	IVAR(1) 1-5	IVAR(2) 6-10	IVAR(3) 11-15	IVAR(4) 16-20	IVAR(5) 21-25	IVAR(6) 26-30	IVAR(7) 31-35	IVAR(8) 36-40
A	X							
B								
C		AS MANY AS 8 LAYER VARIABLES MAY BE TESTED IN OPTION A						
D								
E								
F								
G								
H								
I								
J								

CARD TYPE E

VARIABLE / OPTION \ COLUMN	TVALU(1) 1-12	TVALU(2) 13-24	TVALU(3) 25-36	TVALU(4) 37-48	TVALU(5) 49-60	TVALU(6) 61-72		
A	X							
B								
C		AS MANY AS 8 LAYER-VARIABLE VALUES MAY BE TESTED IN OPTION A. ADDITIONAL CARD TYPE E IS NEEDED IF MORE THAN 6 VALUES ARE USED.						
D								
E								
F								
G								
H								
I								
J								

CARD TYPE F

VARIABLE / OPTION \ COLUMN	IADVR(1) 1-5	IADVR(2) 6-10	IADVR(3) 11-15	IADVR(4) 16-20	IADVR(5) 21-25	IADVR(6) 26-30	IADVR(7) 31-35	IADVR(8) 36-40		
A										
B										
C	X	X	X		AS MANY AS 8 ADDITIONAL LAYER VARIABLES MAY BE SELECTED.					
D	X	X	X							
E	X	X	X							
F	X	X	X							
G	X	X	X							
H	X	X	X							
I	X	X	X							
J	X	X	X							

FIGURE A-12.—Description of card types D, E, and F.

CARD TYPE G

OPTION \ VARIABLE	COLUMN	ISTOR(1) 1-5	ISTOR(2) 6-10	ISTOR(3) 11-15	ISTOR(4) 16-20	ISTOR(5) 21-25	ISTOR(6) 26-30	ISTOR(7) 31-35	ISTOR(8) 36-40	ISTOR(9) 41-45	ISTOR(10) 46-50	ISTOR(11) 51-55	ISTOR(12) 56-60	ISTOR(13) 61-65	ISTOR(14) 66-70	ISTOR(15) 71-75	ISTOR(16) 76-80
A		X	X	X													
B		X	X	X													
C		X	X	X		AS MANY AS 21 TEST-HOLE-RELATED VARIABLES MAY BE SELECTED IN ANY OPTION. ADDITIONAL CARD TYPE G IS NEEDED FOR MORE THAN 16 VARIABLES.											
D		X	X	X													
E		X	X	X													
F		X	X	X													
G		X	X	X													
H		X	X	X													
I		X	X	X													
J		X	X	X													

CARD TYPE H

OPTION \ VARIABLE	COLUMN	MAJTS(1) 1-5	MAJTS(2) 6-10	MAJTS(3) 11-15	MAJTS(4) 16-20	MAJTS(5) 21-25	MAJTS(6) 26-30	MAJTS(7) 31-35	MAJTS(8) 36-40	MAJTS(9) 41-45	MAJTS(10) 46-50	
A												
B		X	X	X								
C						AS MANY AS 10 TYPES OF MATERIAL MAY BE SELECTED.						
D												
E												
F												
G												
H												
I												
J												

CARD TYPE I

OPTION \ VARIABLE	COLUMN	MACOL(1) 1-5	MACOL(2) 6-10	MACOL(3) 11-15	MACOL(4) 16-20	MACOL(5) 21-25	MACOL(6) 26-30	MACOL(7) 31-35	MACOL(8) 36-40	MACOL(9) 41-45	MACOL(10) 46-50	
A												
B												
C		X	X			AS MANY AS 10 LITHOLOGY COLORS MAY BE SELECTED						
D												
E												
F												
G												
H												
I												
J												

FIGURE A-13.—Description of card types G, H, and I.

CARD TYPE J

VARIABLE / OPTION (COLUMN)	SUBDA 1-10	SUBTS 11-20	SUBIN 21-30
A			
B			
C			
D	X	X	X
E			
F			
G			
H			
I			
J			

CARD TYPE K

VARIABLE / OPTION (COLUMN)	AINC(1) 1-5	AINC(2) 6-10	AINC(3) 11-15	AINC(4) 16-20	AINC(5) 21-25	AINC(6) 26-30	AINC(7) 31-35	AINC(8) 36-40	AINC(9) 41-45	AINC(10) 46-50	AINC(11) 51-55	AINC(12) 56-60	AINC(13) 61-65	AINC(14) 66-70	AINC(15) 71-75	AINC(16) 76-80
A																
B																
C			AS MANY AS 16 INCREMENTS ABOVE													
D																
E	X		BEDROCK MAY BE USED IN OPTION E.													
F																
G																
H																
I																
J																

CARD TYPE L

VARIABLE / OPTION (COLUMN)	AKVAL(1) 1-8	AKVAL(2) 9-16	AKVAL(3) 17-24	AKVAL(4) 25-32	AKVAL(5) 33-40	AKVAL(6) 41-48	AKVAL(7) 49-56	AKVAL(8) 57-64	AKVAL(9) 65-72	AKVAL(10) 73-80	
A											
B											
C			AS MANY AS 10 DISCRETE VALUES OF PERMEABILITY								
D											
E			MAY BE SELECTED								
F											
G											
H											
I	X	X	X	X	X						
J											

FIGURE A–14.—Description of card types J, K, and L.

CARD TYPE M

VARIABLE / OPTION (COLUMN)	SVAL(1) 1-8	SVAL(2) 9-16	SVAL(3) 17-24	SVAL(4) 25-32	SVAL(5) 33-40	SVAL(6) 41-48	SVAL(7) 49-56	SVAL(8) 57-64	SVAL(9) 65-72	SVAL(10) 73-80
A										
B										
C			AS MANY AS 10 STORAGE-COEFFICIENT VALUES							
D										
E			MAY BE SELECTED.							
F										
G										
H										
I	X	X	X	X	X					
J										

CARD TYPE N

VARIABLE / OPTION (COLUMN)	IMO 1-5	IDY 6-10	IYR 11-15	ITIM 16-20	JMO 21-25	JDY 26-30	JYR 31-35	JTIM 36-40
A								
B	BEGIN SELECTED				END SELECTED			
C								
D	TIME PERIOD				TIME PERIOD			
E								
F								
G	X	X	X	X	X	X	X	X
H								
I	X	X	X	X	X	X	X	X
J								

FIGURE A-15.—Description of card types M and N.

List of Variables

Variable name	*Option*	*Format*	*Description of variable*
		Card Type A	
NWELL	A–J	I5	Number of test holes to be searched for data retrieval.
LVAR	A	I5	Number of lithologic-layer variables to be retrieved.
NUM	A	I5	Number of selected values of lithologic-layer variables to be retrieved.
LVAR1	C–J	I5	Number of additional lithologic-layer data to be retrieved.
NVAR	A–J	I5	Number of descriptive well data to be retrieved.
ICOND	B	I5	Number of lithologic materials to be retrieved.
ICOL	C	I5	Number of lithologic colors to be retrieved.
IDAT	D	I5	If a 1 is punched in column 40, data are retrieved from subdatum planes (see card type J). If column 40 is blank, this option is bypassed.

Variable name	*Option*	*Format*	*Description of variable*
		Card Type A—Continued	
INC	E	I5	An integer punched in columns 41–45 is the number of increments to be searched above bedrock (see card type K). If columns 41–45 are blank, this option is bypassed.
ILOG	F	I5	A 1 in column 50 indicates a total test-hole-log retrieval. If column 50 is blank, only the selected layer variable is retrieved.
ILVL	G	I5	A 1 in column 55 calls water level for defining saturated zone (see card type N). If column 55 is blank, this option is bypassed.
IGSUB	H	I5	An integer in columns 56–60 indicates the number of feet below ground surface to be searched by increments. If columns 56–60 are blank, this option is bypassed.
KTESK	I	I5	An integer in columns 61–65 indicates the number of permeability values assigned (see card type L). If columns 61–65 are blank, this option is bypassed.
KTESS	I	I5	An integer in columns 66–70 indicates the number of storage-coefficient values assigned (see card type M). If columns 66–70 are blank, this option is bypassed.
KSAT	I	I5	If column 75 is a 1, K and S values are averaged for the total well log. If column 75 is blank, K and S values are averaged only for the saturated zone.
		Card Type B	
IPUNH(1)	D,E,G	I5	A 1 in column 5 causes retrieved layer data to be punched on cards.
IPUNH(2)	J	I5	A 1 in column 10 causes the net thickness of selected lithologic layers to be punched on cards.
IPUNH(3)	B–J	I5	A 1 in column 15 causes test-hole (well) variables to be punched on cards.
IPUNH(4)	C,F	I5	A 1 in column 20 causes lithologic color to be punched on cards.
IPUNH(5)	B	I5	A 1 in column 25 causes lithologic material type to be punched on cards.
IPUNH(6)	I	I5	A 1 in column 30 causes the weighted average of hydraulic coefficients to be punched on cards.

Note: A blank in appropriate columns will bypass punch output for that option.

Variable name	*Option*	*Format*	*Description of variable*
		Card Type C	
IWELL(n)	A–J	16I5	This array is used to select test-hole data by numbers. As many as 1,000 drill-hole numbers may be retrieved from this array selectively.

Note: n indicates array size.

Variable name	*Option*	*Format*	*Description of variable*
		Card Type D	
IVAR(n)	A	8I5	Data are retrieved from this array for as many as 8 lithologic-layer variables. These variables describe hydraulic and geologic characteristics for discrete layers.

Variable name	*Option*	*Format*	*Description of variable*
		Card Type E	
TVALU(*n*)	A	6F12.4	Data are retrieved from this array for as many as 8 test values (6 per card). One or more values may be tested for each variable indicated on card type D. Additional card type E is needed for more than 6 values.
		Card Type F	
IADVR(*n*)	C–J	8I5	Data are retrieved from this array for as many as 8 layer-variable values in addition to the ones tested for using card types D and E.
		Card Type G	
ISTOR(*n*)	A–J	16I5	Data are retrieved from this array for as many as 21 drill-hole variables. An additional card, type G, is needed for more than 16 test-hole variables.
		Card Type H	
MAJTS(*n*)	B	10I5	Data are retrieved from this array for as many as 10 discrete types of material based upon size-distribution analyses.
		Card Type I	
MACOL(*n*)	C	10I5	Data are retrieved from this array for as many as 10 discrete colors of material.
		Card Type J	
SUBDA	D	F10.0	Maximum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBTS	D	F10.0	Minimum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBIN	D	F10.0	The distance in feet to be stepped down for subsequent subdatum planes from SUBDA to SUBTS.
		Card Type K	
AINC(*n*)	E	16I5	Data are retrieved from this array for as many as 16 increments (feet above bedrock) for which data are retrieved.
		Card Type L	
AKVAL(*n*)	I	10F8.0	Data are retrieved from this array for as many as 10 discrete permeability values.
		Card Type M	
SVAL(*n*)	I	10F8.0	Data are retrieved from this array for as many as 10 discrete storage-coefficient values.

Variable name	*Option*	*Format*	*Description of variable*
		Card Type N	
IMO	G,I	I5	Month of beginning of time period for which ground-water levels are averaged when data are retrieved from the saturated zone.
IDY	G,I	I5	Day of beginning of time period.
IYR	G,I	I5	Year of beginning of time period.
ITIM	G,I	I5	Time (military) of beginning of time period.
JMO	G,I	I5	Month of ending of time period.
JDY	G,I	I5	Day of ending of time period.
JYR	G,I	I5	Year of ending of time period.
JTIM	G,I	I5.	Time (military) of ending of time period.

APPENDIX B.—FORMATS USED FOR DATA STORAGE

INPUT-CARD FORMAT USED TO STORE DRILL-HOLE DATA

I2	I5	I5	I5	I5	F 11.3	F 11.3	F 11.3	F 11.3	
VARIABLE NO. (1-21)	DRILL-HOLE NO.	DRILL-HOLE NO.	DRILL-HOLE NO.	DRILL-HOLE NO.	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	COLUMN 67-80 BLANK

INPUT-CARD FORMAT USED TO STORE LAYER DATA

I4	F4.0	F4.0	IX, F5.0	F3.0	F3.0	F 7.0	F 7.0	F 10.0	I4	
DRILL-HOLE NUMBER (STORED WITH DRILL-HOLE DATA)	LAYER NUMBER (1)	LAYER THICKNESS (2)	TYPE OF MATERIAL (3)	COLOR OF MATERIAL (4)	METHOD OF ANALYSIS (5)	TRANSMISSIBILITY (T) (6)	PERMEABILITY (K) (7)	STORAGE COEFFICIENT (S) (8)	NUMBER OF LAYERS (STORE WITH DRILL-HOLE DATA)	COLUMNS 53-80 BLANK

INPUT-CARD FORMAT USED TO STORE WATER-LEVEL DATA

I4	I2	I7	I5	F 7.2	I7	I5	F7.2	I7	I5	F 7.2	
WELL NO. *	CODE NO. **	DATE MONTH, DAY, YEAR 2 DIGITS EACH	MILITARY TIME	DEPTH TO WATER *** FEET BELOW TOP OF PIPE	DATE	TIME	DEPTH	DATE	TIME	DEPTH	COLUMN 64-80 BLANK

* ALL I FORMAT INPUT DATA IS RIGHT JUSTIFIED
** CODE 1 = RECORDER-CHART DATA — CODE 2 = TAPE-DOWN DATA
*** NO ZERO PUNCHES NEEDED IN BLANKS ON CARDS

FIGURE B-1.—Input card formats.

APPENDIX C.–SOURCE LISTING FOR STORAGE AND RETRIEVAL PROGRAMS

CARD

```
      C                                 APPENDIX C
      C
      C
      C               RETRIEVAL PROGRAM FOR HYDROGEOLOGIC DATA
      C       SUBROUTINES USED NAMED (CODE, KTESX, COLOR, SERCH, MATRL, TAPES, JULDY,
      C       WATLV)
              DEFINE FILE 1(1000,161,U,ISEC),2(21,1000,U,ISEC1),3(10,320,U,IM)
              DIMENSION V(21),VV(21),VAR(8)
              DIMENSION MAJTS(10),MACOL(10),WATEL(1000),AINC(20),IPUNH(6)
              COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
              COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
              COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
      C       HEADERS READ IN FOR LABELING VARIALBLES.
      C       CONTROLS FOR SELECTING WELL VARIABLES.
      C       FORMAT(16I5)
      C
      C       NWELL-NUMBER OF WELLS TO BE SEARCHED.
      C       LVAR -NUMBER OF LAYER VARIABLES TO BE TESTED.
      C       LVAR1-NUMBER OF LAYER TEST VALUES, TVALU (I), TO BE READ IN.
      C       VALUES OF (TVALU (I) FORMAT (6F12.4,/2F12.4))
      C       NUM  -NUMBER OF ADDITIONAL LAYER VARIABLES NOT USED FOR SEARCHING.
      C       NVAR -NUMBER OF WELL VARIABLES
      C       ICOND-'0'-BYPASS
      C             '1'-CALLS IN SUBROUTINE FOR TESTING TYPE OF MATERIAL IN THE LAYERS.
      C       ICOL- '0'-BY-PASS
      C             '1'-CALLS IN SUBROUTINE FOR TESTING LAYER COLORS.
      C       IDAT- '0'-BY-PASS
      C             '1'-READS IN SUBSTRATUM ELEVATION TO BE TESTED. (SUBDA)
      C       INC - '0'-BY PASS
      C             'N'-READS IN NUMBER OF INCREMENTS IN FEET ABOVE BEDROCK TO BE
      C                 SEARCHED.
      C       ILOG- '0'-WRITES OUT LAYER VARIABLE SEARCHED
      C             '1'-WRITES OUT ALL LAYERS IN A WELL
      99997 CONTINUE
      C       ILVL- '0' BY PASS
      C             '1' WATER LEVEL CALLED FOR SEARCHING IN SATURATED ZONE
      C       IGSUB-'0' BY PASS
      C             '1' STEPS DOWN INCREMENTALLY BELOW GROUND SURFACE
      C       KTESK-'0' BY PASS
      C             'N' NUMBER OF PERMEABILITY VALUES TO BE USED
      C       KTESS-'0' BY PASS
      C             'N' NUMBER OF STORAGE COEFFICIENT VALUES TO BE USED
      C       KSAT- '0' BY PASS
      C           , '1' K AND S VALUES ARE AVERAGED FOR TOTAL THICKNESS
      C       PUNCH A '1' IN ILVL AND A '0' IN KSAT TO AVERAGE K AND S VALUES IN THE
      C       SATURATED ZONE
      C       FORMAT FOR VARIABLES NWELL THROUGH KSAT IS 15I5.
      99998 CONTINUE
      C       IPUNH (N) - '0' NO PUNCH  '1' PUNCH
      C       THE FOLLOWING PUNCH COMMANDS ARE IN SIX SEPARATE FIVE COLUMN FIELDS.
      C       THE NUMBER FOLLOWING EACH COMMAND IS THE FIELD NUMBER.
      C                       LAYER DATA (1)
      C                       NET THICKNESS (2)
      C                       WELL VARIABLES (3)
      C                       COLOR OF LITHOLOGY (4)
      C                       MATERIAL TYPE OF LITHOLOGY (5)
      C                       WGT. AVE. PERM. AND WGT. AVE. STOR. COEFF. (6)
      C       VALUES OF SUBDA, SUBTS, SUBIN (FORMAT (3F10.0))
      C       SUBDA-SUBSTRATUM ELEVATION
      C       SUBTS-MINIMUM ELEVATION TO BE SEARCHED
      C       SUBIN-INCREMENT IN FEET TO BE SUBTRACTED FROM SUBDATUM
      C       SUBROUTINE TAPES LOADS TEST HOLE AND LAYER DATA FROM TAPES TO DISC FILE
      C       FOR SEARCHING.
              CALL TAPES
```

```
      DO 1000 J=1,2
C     READ LAYER VARIABLE NAMES FROM CONTROL CARDS
 1000 READ(5,106)(HEAD(J,I),I=1,108)
  106 FORMAT(72A1,/,36A1)
      IM=1
C     WRITES LAYER VARIABLE NAMES ON DISC
      WRITE(3'IM)HEAD
      DO 999 J=1,2
C     READ TEST HOLE VARIABLE NAMES FROM CONTROL CARDS
  999 READ(5,107)(HEAD(J,I),I=1,252)
  107 FORMAT(72A1/72A1/72A1/36A1)
      IM=3
C     WRITES TEST HOLE VARIABLE NAMES ON DISC
      WRITE(3'IM)HEAD
 1012 READ(5,  100)NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IL
     1VL,IGSUB,KTESK,KTESS,KSAT
C     TEST ON NUMBER OF TEST HOLES TO BE SEARCHED
      IF(NWELL)1013,1013,4000
C     READ TEST HOLE NUMBERS TO BE SEARCHED (16I5) INTO ARRAY
 4000 READ(5,100)(IPUNH(I),I=1,6)
      READ(5,100)(IWELL(I),I=1,NWELL)
  100 FORMAT(16I5)
C     TEST ON NUMBER OF LAYER VARIABLES TO BE TESTED
 4001 IF(LVAR)4003,4003,4002
C     READ VARIABLES TO BE TESTED INTO ARRAY
 4002 READ(5,100)(IVAR(I),I=1,LVAR)
C     TEST ON NUMBER OF TEST VALUES TO BE TESTED FOR
 4003 IF(LVAR1)4005,4005,4004
C     READ VALUE OF LAYER VARIABLE TO BE TESTED INTO ARRAY
 4004 READ(5,101)(TVALU(I),I=1,LVAR1)
  101 FORMAT (6F12.4,/2F12.4)
C     TEST ON NUMBER OF ADDITIONAL LAYER VARIABLES NEEDED(1-7)
 4005 IF(NUM)4007,4007,4006
C     READ ADDITIONAL LAYER VARIABLES INTO ARRAY
 4006 READ(5,100)(IADVR(I),I=1,NUM)
C     TEST ON NUMBER OF ADDITIONAL TEST HOLE VARIABLES (1-21)
 4007 IF(NVAR)4009,4009,4008
C     READ ADDITIONAL TEST HOLE VARIABLES INTO ARRAY
 4008 READ(5,100)(ISTOR(I),I=1,NVAR)
C     TEST IF SUBDATUM ELEVATION IS TO BE SEARCHED
 4009 IF(IDAT)3021,3021,3023
C     TEST IF A HEIGHT ABOVE BEDROCK IS TO BE SEARCHED
 3021 IF(INC)3022,3022,3024
 3024 READ(5,1112)(AINC(I),I=1,INC)
 1112 FORMAT(16F5.1)
      GO TO 3124
 3022 SUBDA=0.0
      GO TO 3124
C     READ FROM ONE CARD,(1)ELEV TO BE SEARCHED,(2)ELEV TO STOP ON,(3)
C     INCREMENT TO STEP DOWN-FEET
 3023 READ(5,500)SUBDA,SUBTS,SUBIN
  500 FORMAT(3F10.0)
C     TEST IF MAJOR OR MINOR LITHOLOGIC TYPE WANTED
 3124 IF(ICOND)5002,5002,5001
C     READ CODE OF LITHOLOGY WANTED INTO ARRAY
 5001 READ(5,100)(MAJTS(I),I=1,ICOND)
C     TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED
 5002 IF(ICOL)5004,5004,5003
 5003 READ(5,100)(MACOL(I),I=1,ICOL)
 5004 LIST=NUM+LVAR
      KTEST=KTESK+KTESS
      IF(KTESK)1122,1122,1120
 1120 READ(5,1121)(AKVAL(I),I=1,KTESK)
 1121 FORMAT(10F8.0)
 1122 IF(KTESS)1124,1124,1123
 1123 READ(5,1121)(SVAL(I),I=1,KTESS)
 1124 CALL CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IPUNH
     1,ILVL,MAJTS,MACOL,LIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,IGSUB,KT
     2ESK,KTESS,AKVAL,SVAL,AINC)
      IF(ICOND)5006,5006,5005
 5005 CALL MATRL(ICOND,NWELL,MAJTS,IPUNH(5))
```

```
 5006 IF(ICOL)5080,5080,5007
 5007 CALL COLOR(ICOL,NWELL,MACOL,IPUNH(4))
 5080 IF(IGSUB)2,2,1
    1 SUBDA=1.0
      AMIN=9999.
      GO TO 8002
    2 IF(SUBDA)8000,8000,8002
 8000 IF(ILVL)8002,8002,8001
 8001 CALL WATLV(NWELL,IWELL,WATEL)
 8002 IF(LIST)6004,6004,3014
 3014 IM=1
C     READS HEADERS OF LAYER VARIABLES FROM DISC
      READ(3'IM)HEAD
      DO 1003 K=1,2
      J=0
C     TEST FOR NUMBER OF VARIABLES TO BE SELECTED
      IF(LVAR)903,903,902
  902 DO 1002 JC=1,LVAR
C     SELECTS HEADERS FOR VARIABLES
      ISTRT=(IVAR(JC)*12-11)
      IEND=ISTRT+11
      DO 1001 L=ISTRT,IEND
      J=J+1
 1001 TITLE(K,J)=HEAD(K,L)
 1002 CONTINUE
C     TEST FOR ADDITIONAL LAYER VARIABLES
      IF(NUM)1003,1003,903
  903 DO 2002 JC=1,NUM
C     SELECTS HEADERS FOR LAYER VARIABLES
      ISTRT=(IADVR(JC)*12-11)
      IEND=ISTRT+11
      DO 2001 L=ISTRT,IEND
      J=J+1
 2001 TITLE(K,J)=HEAD(K,L)
 2002 CONTINUE
 1003 CONTINUE
C     TEST ON SUBDATUM ELEV
      IF(SUBDA)5016,5016,3012
 5016 IF(ILVL)3013,3013,5017
C     LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEVATION OF THE
C     TOP OF A LAYER, AND ELEVATION OF THE TOP OF SATURATED ZONE.
 5017 WRITE(6,109)
      WRITE(6,5018)
 5018 FORMAT('+','  WN SUB   LD L ELEV SATURATED ZONE')
      GO TO 3013
 3012 WRITE(6,109)
C     LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEV OF TOP OF
C     LAYER IN WHICH SUBDATUM IS FOUND
  109 FORMAT('0')
      WRITE(6,108)
  108 FORMAT('+','  WN SUB   LD L ELEV')
 3013 IEND=J
      DO 1004 K=1,2
C     WRITES HEADERS FOR VARIABLES
 1004 WRITE(6,115)(TITLE(K,J),J=1,IEND)
  115 FORMAT (' ',22X, 96A1)
      ELV1=0.0
      ICONT=0
      JCONT=0
C     SET BRANCH =1
C     READ A TEST HOLE NUMBER TO BE SEARCHED
 7001 SUB=SUBDA
      ICONT=ICONT+1
      IF(INC)1110,1110,1113
 1110 IINC=1
      GO TO 1114
 1113 IINC=INC
 1114 DO 1111 II=1,IINC
      DO 10 IC=1,NWELL
      LTEST=0
      IBRN=1
```

```
      ISEC=21
      JBRN=2
      SUBDA=SUB
      IF(SUBDA)5000,5000,3001
 5000 IF(ILVL)3001,3001,502
  502 JBRN=1
C     READS TOTAL NUMBER OF LAYERS FOR EACH TEST HOLE FROM DISC
 3001 READ (2'ISEC)WVAR
      IKK=IWELL(IC)
C     BRANCHES TO DIFFERENT PARTS OF PROGRAM
      GO TO(3002,3003,53),IBRN
C     SETS MAXLA EQUAL TO TOTAL NO. OF LAYERS FOR EACH TEST HOLE
 3002 MAXLA=WVAR(IKK)
      GO TO 3004
C     READS GROUND SURFACE ELEV FOR EACH TEST HOLE FROM DISC
 3003 GSELV=WVAR(IKK)
      GSURF=GSELV
C     SETS SECTOR TO FIND BEDROCK ELEV
      ISEC=7
C     SET BRANCH = 3
      IBRN=3
      GO TO 3001
C     READS BEDROCK ELEV FOR EACH TEST HOLE FROM DISC
   53 BEDRK=WVAR(IKK)
C     TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
      IF(INC)3006,3006,9001
C     ESTABLISH SUBDATUM ELEV ABOVE BEDROCK
 9001 SUBDA=BEDRK+AINC(II)
      GO TO 3006
C     TEST IF SUBDATUM ABOVE BEDROCK EXISTS
 3004 IF(SUBDA)9999,9999,3005
 9999 IF(ILVL)9002,9002,3005
C     TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
 9002 IF(INC)3006,3006,3005
C     SETS SECTOR TO SELECT GROUND SURFACE ELEV.
 3005 ISEC=6
C     SET BRANCH = 2
      IBRN=2
      GO TO 3001
 3006 IF(IGSUB)12001,12001,2000
 2000 SUBDA=GSURF
      SUBDA=SUBDA-(IGSUB*ICONT)
      SUBTS=BEDRK
      IF(SUBTS)2003,2003,2005
 2003 WRITE(6,2004)IWELL(IC)
 2004 FORMAT('0',25('*'),'NO BEDROCK ELEVATION FOR WELL ',I4,25('*'),//)
      GO TO 10
 2005 IF(BEDRK-AMIN)2006,12001,12001
 2006 AMIN=BEDRK
12001 ISEC2=IWELL(IC)
      ILAY=1
      READ (1'ISEC2)STRAT
      SUM=0.0
      THIK=0.0
 7005 IWLL=IWELL(IC)
C     TEST IF TEST HOLE HAS A LOG
 7006 IF(MAXLA)10,10,200
C     TEST HOLES WITH MORE THAN TWENTY LAYERS ARE WRITTEN ON PRINTER.
  200 IF(MAXLA-20)203,203,202
  202 WRITE(6,104)IWELL(IC)
  104 FORMAT(' ','LAYER NUMBER GREATER THAN 20 ON TEST HOLE ',I4)
      GO TO 10
C     READS THROUGH TEST HOLE LAYERS
  203 IF(ILVL)9997,9997,5009
 5009 SUBDA=WATEL(IKK)
 9997 DO 90 JLAY=1,MAXLA
C     SUMS LAYER THICKNESS
      SUM=SUM + STRAT(ILAY,2)
C     TEST IF SUBDATUM ELEV IS READ
    5 CONTINUE
 5008 IF(SUBDA)3008,3008,3007
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 3007 IF(SUBDA-GSELV)4016,4016,10
 4016 IF(SUBDA-BEDRK)10,4017,4017
C      SUBTRACT LAYER THICKNESS OFF GROUND SURFACE
 4017 ELEV=GSELV-STRAT(ILAY,2)
C      TEST NEW GROUND SURF AGAINST SUBDATUM ELEV
      IF (ELEV-SUBDA)3010,3010,3009
C      RESETS GROUND SURFACE TO TOP OF NEXT LAYER
 3009 GSELV=ELEV
C      INCREASE LAYER NO. BY 1
      ILAY=ILAY+1
      GO TO 90
C      COMPUTES DEPTH TO TOP OF LAYER CONTAINING SUBDATUM
 3010 GO TO (5010,5012),JBRN
 5010 JBRN=2
      SUM=GSURF-SUBDA
      STRAT(ILAY,2)=SUBDA-ELEV
      ELEV=SUBDA
      GSELV=SUBDA
      SUM=SUM+STRAT(ILAY,2)
      IF(KSAT)3007,3007,7008
 7008 CALL KTESX(ILAY,S7,S8,AKV1,SV1)
 5012 DTOLA=GSURF-GSELV
C      TEST IF ADDITIONAL LAYER VARIABLES
 3020 IF(NUM)3016,3016,3017
 3017 DO 3015 IJJ=1,NUM
C      SETS K TO ADDITIONAL LAYER VARIABLE
      K=IADVR(IJJ)
C      SETS IV TO THE NUMBER OF THE ADDITIONAL LAYER VARIABLES PLUS THE NUMBER OF
C      LAYER VARIABLES TO BE SELECTED
      IV=IJJ+LVAR
C      STORES ADDITIONAL LAYER VARIABLES IN ARRAY
 3015 VAR(IV)=STRAT(ILAY,K)
      IF(LVAR)3016,3025,3016
 3016 DO 3011 IJ=1,LVAR
C      SETS K TO LAYER VARIABLE TO BE SELECTED
      K=IVAR(IJ)
C      STORES LAYER VARIABLES SELECTED IN ARRAY
 3011 VAR(IJ)=STRAT(ILAY,K)
C      COMPUTES DEPTH TO TOP OF LAYER WHICH CONTAINS SUBDATUM
 3025 ELV=GSURF-(SUM-STRAT(ILAY,2))
C      SETS IDT TO DEPTH TO LAYER
      IDT=DTOLA
C      SETS ISUB TO SUBDATUM ELEVATION
      ISUB=SUBDA
      IF(KSAT)300,300,7003
C      TEST IF LOG OF ALL LAYERS IS WANTED
  300 IF(ILOG)7050,7050,7003
C      WRITE DATA OUT FOR ALL LAYERS
 7050 IF(IGSUB)7051,7051,7003
C      LABELS SUBDATUM ELEVATION, DEPTH TO LAYER, ELEVATION OF TOP OF LAYER
C      CONTAINING SUBDATUM, AND SELECTED VARIABLES.
 7051 IF(ELV-ELV1)7003,10,7003
 7003 WRITE (6,113) IWLL,      ISUB,IDT,ELV,(VAR(I),I=1,LIST)
  113 FORMAT(' ',I3,I5,I4,F8.2,8F12.4)
C      TEST FOR PUNCHED OUTPUT.
      IF(IPUNH(1))94,94,1050
 1050 WRITE(7,1051)IWLL,ISUB,IDT,ELV,(VAR(I),I=1,LIST)
 1051 FORMAT(I3,I5,I4,F8.2,5F12.4,/,5F12.4)
   94 IF(KSAT)301,301,93
  301 IF(ILVL)10,10,95
   95 ILAY=ILAY+1
C      TEST LAYER VARIABLE VALUES SEARCHED.
C      LVAR1 IS THE NUMBER OF VALUES SELECTED FOR EACH LAYER VARIABLE TESTED.
 3008 IF(LVAR1)4018,4018,904
  904 DO 6 JJ=1,LVAR
      K=IVAR(JJ)
      DO 6 J=1,LVAR1
C      TEST DATA IN LAYER AGAINST TEST VALUE
      IF(TVALU(J)-STRAT(JLAY,K))6,4011,6
    6 CONTINUE
      GO TO 9
```

```
C       TEST FOR ADDITIONAL LAYER VARIABLES
 4011 THIK=THIK+STRAT(JLAY,2)
 4018 IF(NUM)6003,6003,4010
 4010 DO 8 IJ=1,NUM
      K=IADVR(IJ)
C       SUMS NUMBER OF LAYER VARIABLES TESTED AND ADDITIONAL LAYER VARIABLES
      IV=IJ+LVAR
    8 VAR(IV)=STRAT(JLAY,K)
C       TEST ON NUMBER OF LAYER VARIABLES TO BE SEARCHED
 6003 IF(LVAR)6001,6001,6000
 6000 DO 7 IJ=1,LVAR
C       SETS K TO THE VARIABLE TESTED
      K=IVAR(IJ)
C       SETS VAR(IJ) TO THE VALUE STORED IN LAYER DATA
    7 VAR(IJ)=STRAT(JLAY,K)
C       TEST ON VARIABLES TO BE SEARCHED FOR OR ADDITIONAL LAYER VARIABLES
 6001 IF(LIST)6004,6004,6002
 6002 IF(ILVL)6020,6020,9
 6020 WRITE(6,103)IWLL,JLAY,(VAR(I),I=1,LIST)
  103 FORMAT(' ',10X,2I5,8F12.4)
C       TEST FOR PUNCHED OUTPUT
      IF(IPUNH(1))9,9,6006
 6006 WRITE(7,6007)IWLL,JLAY,(VAR(IJ),IJ=1,LIST)
 6007 FORMAT(2I4,8F9.2/,8X,8F9.2/,8X,5F9.2)
C       RETURN TO READ NEXT LAYER
    9 IF(KTEST)90,90,6008
 6008 IF(ILVL)92,92,91
   91 KLAY=ILAY-1
      GO TO 920
   92 KLAY=JLAY
C       SUBROUTINE KTESX COMPUTES AVERAGE PERMEABILITY AND STORAGE COEFFICIENT
C       VALUES.
  920 CALL KTESX(KLAY,S7,S8,AKV1,SV1)
   90 CONTINUE
   93 IF(KTEST)6011,6011,6009
 6009 AKV1=AKV1/S7
      SV1=SV1/S8
      WRITE(6,6010)IWLL,AKV1,SV1
 6010 FORMAT(' ','HOLE NUMBER= ',I4,/,' WGT. AVE.PERM.= ',F10.0,/,' WGT.
     1AVE. STORAGE COEFFICIENT= ',F10.3)
      IF(IPUNH(6))6011,6011,11100
11100 WRITE(7,11101)IWLL,AKV1,SV1
11101 FORMAT(I4,F5.0,F5.3)
C       RETURN TO READ NEXT TEST HOLE
 6011 IF(LVAR1)10,10,4019
 4019 WRITE(6,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
  161 FORMAT(' ',' HOLE NO. ',I5,' NET THICK ',F12.0,' CODES ',5X,6F4.0)
      IF(IPUNH(2))10,10,4020
C       PUNCHES DATA ON CARDS
 4020 WRITE(7,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
   10 CONTINUE
 1111 CONTINUE
C       TEST IF SUBDATUM ELEVATION IS SELECTED
 6005 IF(ILVL)99,99,98
   98 SUBDA=0.0
   99 IF(SUBDA)6004,6004,7000
C       TEST IF POINT ABOVE BEDROCK IS SELECTED
 7000 IF(INC)9003,9003,6004
C       STEP DOWN SUBDATUM TO BE SEARCHED
 9003 IF(IGSUB)9004,9004,9005
 9004 SUBDA=SUBDA-SUBIN
      IF(SUBDA-SUBTS)6004,6004,7002
 7002 ELV1=ELV
      GO TO 7001
C       TEST IF SUBDATUM WANTED IS BELOW LOWER LIMIT
 9005 IF(SUBDA-AMIN)6004,6004,7001
C       RESET ELEVATION OF TOP OF LAYER
C       TEST IF ADDITIONAL TEST HOLE VARIABLES ARE SELECTED
 6004 IF(NVAR)1011,1011,11
C       SET DISC SECTOR
   11 IM=3
```

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C      READ HEADERS FOR ADDITIONAL TEST HOLE VARIABLES
       READ (3'IM) HEAD
       JSTRT=1
       JEND=9
       DO 1009 IL=1,3
C      TEST IF NUMBER IS MORE THAN NINE
       IF (NVAR-JEND)1010,1010,12
C      SETS NUMBER OF VARIABLES TO BE WRITTEN
  1010 JEND=NVAR
    12 DO 1007 K=1,2
       J=0
C      READS NINE HEADERS FROM DISC STORAGE
       DO 1006 JC=JSTRT,JEND
       ISTRT=(ISTOR(JC)*12-11)
       IEND=ISTRT+11
       DO 1005 L=ISTRT,IEND
       J=J+1
  1005 TITLE(K,J)=HEAD(K,L)
  1006 CONTINUE
  1007 CONTINUE
       IEND=J
       DO 1008 K=1,2
C      WRITES NINE HEADERS ON EACH PRINTER LINE
  1008 WRITE (6,105) (TITLE (K,J),J=1,IEND)
   105 FORMAT(' ',108A1)
C      TEST IF SUBDATUM ELEVATION IS SELECTED
       DO 22 J=1,NWELL
       DO 20 I=JSTRT,JEND
C      STORES SELECTED VARIABLES ON DISC
       ISEC1=ISTOR(I)
C      READS VARIABLES FROM DISC
       READ (2'ISEC1)WVAR
C      SETS IK TO TEST HOLE NUMBER
       IK=IWELL(J)
C      SETS IKK TO VARIABLE
       IKK=ISTOR(I)
       V(IKK)=WVAR(IK)
    20 CONTINUE
       DO 21 I=JSTRT,JEND
       K=ISTOR(I)
    21 VV(I)=V(K)
C      WRITES VARIABLES FOUND AT SUBDATUM ON PRINTER
       WRITE (6,5400) (VV(I),I=JSTRT,JEND)
  5400 FORMAT(' ',9F12.3)
C      TEST FOR PUNCHED OUTPUT
       IF(IPUNH(3))22,22,1054
  1054 WRITE(7,1055)(VV(I),I=JSTRT,JEND)
  1055 FORMAT(6F12.3,/,6F12.3,/,6F12.3,/,3F12.3)
C      PUNCHES VARIABLES FOUND AT SUBDATUM, SIX PER CARD
    22 CONTINUE
C      TEST IF ALL VARIABLES SELECTED HAVE BEEN WRITTEN
       IF (JEND-NVAR)23,1011,1011
C      RESET TO NEXT NINE HEADINGS AND VARIABLES
    23 JSTRT=JEND+1
       JEND=JEND+9
  1009 CONTINUE
  1011 CONTINUE
       GO TO 1012
  1013 STOP
       END
C
C
C      SUBROUTINE CODE DISPLAYS A LIST OF OPTIONS SELECTED BY THE USER.
C      RETRIEVAL CONTROL CARD CODING IS DISPLAYED ON PRINTER FOR EACH JOB SETUP.
       SUBROUTINE CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG
      1,IPUNH,ILVL,MAJTS,MACOL,ILIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,I
      2GSUB,KTESK,KTESS,AKVAL,SVAL,AINC)
       DIMENSION AKVAL(10),SVAL(10),AINC(20)
       DIMENSION MAJTS(10),MACOL(10),ISTOR(21),IADVR(8),IPUNH(6)
       COMMON IWELL(1000),IVAR(8),TVALU(8)
       WRITE(6,120)
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      120 FORMAT('1',' IF TEST CODES ARE EQUAL TO 1, THEN TEST IS USED, IF E
         1QUAL TO 0, THEN TEST IS BY-PASSED',//)
          WRITE(6,100) NWELL
      100 FORMAT(' ','NUMBER OF TEST HOLES TO BE SEARCHED= ',I3)
          WRITE(6,133)(IWELL(I),I=1,NWELL)
      133 FORMAT(' ','TEST HOLES THAT ARE BEING TESTED ARE',/,41(24I5,/))
          WRITE(6,101)LVAR
      101 FORMAT('0','NUMBER OF LAYER VARIABLES TO BE TESTED= ',I2)
          IF (LVAR)2,2,1
        1 WRITE(6,102)(IVAR(I),I=1,LVAR)
      102 FORMAT(' ','THE VARIABLES THAT ARE TO BE TESTED ARE'/,8I5)
        2 WRITE(6,103)LVAR1
      103 FORMAT('0','NUMBER OF TEST VALUES= ',I2)
          IF(LVAR1)4,4,3
        3 WRITE(6,104)(TVALU(I),I=1,LVAR1)
      104 FORMAT(' ','TEST VALUES OF EACH LAYER ARE',/,8F10.4)
        4 WRITE(6,105)NUM
      105 FORMAT('0','NUMBER OF ADDITIONAL LAYER VARIABLES= ',I2)
          IF(NUM)6,6,5
        5 WRITE(6,106)(IADVR(I),I=1,NUM)
      106 FORMAT(' ','ADDITIONAL LAYER VARIABLES ARE',/,8I5)
        6 WRITE(6,116)ILIST
      116 FORMAT('0','TOTAL NUMBER OF LAYER VARIABLES THAT ARE CALLED= ',I2)
          WRITE(6,107)NVAR
      107 FORMAT('0','NUMBER OF TEST HOLE VARIABLES= ',I2)
          IF(NVAR)8,8,7
        7 WRITE(6,108)(ISTOR(I),I=1,NVAR)
      108 FORMAT(' ','THE TEST HOLE VARIABLES ARE',/,21I5)
        8 WRITE(6,109)IDAT
      109 FORMAT('0','SUBDATUM ELEVATION CODE= ',I2)
          IF(IDAT)10,10,9
        9 WRITE(6,110)SUBDA,SUBTS,SUBIN
      110 FORMAT(' ','ELEVATION TO BE SEARCHED= ',F10.0,/,' ELEVATION TO TER
         1MINATE SEARCHING= ',F10.0,/,' STEP-DOWN INCREMENT= ',F10.0)
       10 IF(INC)132,132,130
      130 WRITE(6,131)INC,(AINC(I),I=1,INC)
      131 FORMAT('0NUMBER OF HEIGHT INCREMENTS ABOVE BEDROCK TO BE SEARCHED
         1= ',I2,/,' THE INCREMENT VALUES ARE',/,20F10.2)
      132 WRITE(6,112)ICOND
      112 FORMAT('0','TEST IF MAJOR OR MINOR LITHOLOGY TYPE WANTED= ',I2)
          IF(ICOND)12,12,11
       11 WRITE(6,113)(MAJTS(I),I=1,ICOND)
      113 FORMAT(' ','LITHOLOGY TYPE CODES ARE',/,8I5)
       12 WRITE(6,114)ICOL
      114 FORMAT('0','TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED=',I3)
          IF(ICOL)14,14,13
       13 WRITE(6,115)(MACOL(I),I=1,ICOL)
      115 FORMAT(' ','LITHOLOGY COLOR CODES ARE',/,8I5)
       14 WRITE(6,117)ILVL
      117 FORMAT('0','TEST IF WATERLEVEL OF SATURATED ZONE IS TO BE USED= ',
         1I2)
          WRITE(6,121)KSAT
      121 FORMAT('0TEST IF SATURATED ZONE IS TO BE LOGGED= ',I2)
          WRITE(6,118)ILOG
      118 FORMAT('0','TEST IF ALL LAYERS ARE TO BE LOGGED= ',I2)
          IF(IGSUB)124,124,122
      122 WRITE(6,123)IGSUB
      123 FORMAT('0STEP DOWN INCREMENT FROM GROUND SURFACE ELEVATION= ',I2,
         1' FEET')
      124 IF(KTESK)129,129,125
      125 WRITE(6,126)KTESK
      126 FORMAT('0NUMBER OF K-PERMEABILITY AND S-STORAGE COEF. VALUES= ',I2
         1)
          WRITE(6,127)(AKVAL(I),I=1,KTESK)
      127 FORMAT(' ','THE K-PERMEABILITY VALUES ARE',/,10F8.0)
          WRITE(6,128)(SVAL(I),I=1,KTESS)
      128 FORMAT(' ','THE S-STORAGE COEF. VALUES ARE',/,10F8.3)
      129 WRITE(6,119)(IPUNH(I),I=1,6)
      119 FORMAT('0','TEST FOR PUNCHING DATA',//,5X,'LAYER DATA= ',I2,/,5X,'
         1NET THICKNESS= ',I2,/,5X'TEST HOLE DATA= ',I2,/,5X,'COLOR OF LITHOLOGY=
         1 ',I2,/,5X,'MATERIAL TYPE OF LITHOLOGY= ',I2,/,5X,' WGT. AVE. PERM
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     2. AND WGT. AVE. STOR. COEF.= ',I2)
      RETURN
      END
C
C
C     SUBROUTINE KTESX COMPUTES AVERAGE K AND S VALUES WEIGHTED ON LAYER
C     THICKNESS
      SUBROUTINE KTESX(ILAY,S7,S8,AKV1,SV1)
      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,6)
      COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
      IF(LTEST)10,10,15
   10 S7=0.0
      S8=0.0
      AKV1=0.0
      SV1=0.0
      LTEST=LTEST+1
   15 J7=STRAT(ILAY,7)
      J8=STRAT(ILAY,6)
      IF(J7)21,21,20
   20 S7=S7+STRAT(ILAY,2)
      AKV1=AKV1+(AKVAL(J7)*STRAT(ILAY,2))
   21 IF(J8)26,26,25
   25 S8=S8+STRAT(ILAY,2)
      SV1=SV1+(SVAL(J8)*STRAT(ILAY,2))
   26 RETURN
      END
C
C
      SUBROUTINE COLOR(ICOLR,NWELL,MACOL,IPUNH)
C     SUBROUTINE TO READ AND TEST FOR MAJOR OR MINOR COLOR OF LITHOLOGY
      DIMENSION MACOL(10)
      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
      COMMON ISEC,ISEC1,ISEC2
  100 FORMAT(' ','HOLE NO.',2X,'LAYER NO.',2X,'MAJOR COLOR',2X,'MINOR CO
     1LOR',4X,'ELEV ',3X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR)  NE
     2T THICK(MINOR)')
  101 FORMAT(' ',2X,I3,8X,I2,10X,I2,20X,F6.1,2XF6.1,6X,F6.2)
  102 FORMAT(' ',2X,I3,8X,I2,23X,I2,7X,F6.1,2X,F6.1,6X,F6.2)
  103 FORMAT('+',80X,F6.2)
  104 FORMAT('+',99X,F6.2)
C     WRITE HEADERS FOR COLORS FOUND IN LITHOLOGY
      WRITE(6,100)
C     ICOLR IS THE NUMBER OF COLORS SELECTED
      DO 6 K=1,ICOLR
C     MACOL(K) IS THE NUMERICAL CODE FOR EACH COLOR SELECTED
      JTEST=MACOL(K)
C     NWELL IS THE NUMBER OF TEST HOLES TO BE SEARCHED
      DO 5 IC=1,NWELL
C     CALLS SUBROUTINE NAMED 'SERCH'
      CALL SERCH(NLAY,GSELV,IC)
C     SETS SECTOR TO TEST HOLE NO. BEING SEARCHED
      ISEC2=IWELL(IC)
C     READS FROM DISC LAYER DATA
      READ (1'ISEC2)STRAT
      SUM=0.0
      SUM2=0.0
      SUM3=0.0
      J=1
C     SETS IWLL TO TEST HOLE NO. BEING SEARCHED
   52 IWLL=IWELL(IC)
C     READS LAYER DATA FOR ALL LAYERS IN EACH TEST HOLE
   53 DO 4 JJ=1,NLAY
C     SETS TYPE TO COLOR OF LAYER
   50 TYPE=STRAT(J,4)
C     SETS THICK TO THICKNESS OF LAYER BEING SEARCHED
      THICK=STRAT(J,2)
C     SUMS LAYER THICKNESS OF ALL LAYERS AS SEARCHED
      SUM=SUM+STRAT(J,2)
C     KTEST IS A THREE DIGIT NUMBER (COLOR CODE) OF LAYER
```

```
      KTEST= IFIX(TYPE)/10
C     TEST IF COLOR IN LAYER IS SELECTED COLOR
      IF (KTEST-JTEST) 2, 1, 2
C     SUM1 IS THE THICKNESS TO TOP OF LAYER WHERE COLOR IS FOUND
    1 SUM1=SUM-STRAT(J,2)
      SUM2=SUM2+THICK
C     COMPUTES ELEVATION OF TOP OF LAYER WHERE COLOR IS FOUND
      ELEV=GSELV-SUM1
C     ICOL IS TWO NUMBER CODE
      ICOL = TYPE
C     LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH TO
C     LAYER, LAYER THICKNESS
      WRITE(6,101)IWLL,     JJ,ICOL,ELEV,SUM1,THICK
C     TEST FOR PUNCHED OUTPUT
      IF(IPUNH)4,4,10
C     PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV. OF TOP OF LAYER, DEPTH
C     TO LAYER, LAYER THICKNESS ON ONE CARD
   10 WRITE(7,11)IWLL,JJ,ICOL,ELEV,SUM1,THICK
   11 FORMAT(' COLOR1 ',3I5,F6.1,2X,F6.1,6X,F6.2)
      GO TO 4
    2 KTEST=TYPE-FLOAT(KTEST)*10.
C     TEST IF COLOR ASKED FOR IS MINOR COLOR
      IF(KTEST-JTEST)4,3,4
C     CALCULATES DEPTH TO TOP OF LAYER
    3 SUM1=SUM-STRAT(J,2)
      SUM3=SUM3+THICK
C     CALCULATES ELEV. TOP OF LAYER
      ELEV=GSELV-SUM1
C     ICOL IS A TWO NUMBER CODE
      ICOL=TYPE
C     LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
C     TO LAYER, LAYER THICKNESS
      WRITE(6,102)IWLL,     JJ,ICOL,ELEV,SUM1,THICK
      IF(IPUNH)4,4,12
C     PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
C     TO LAYER, LAYER THICKNESS ON ONE CARD
   12 WRITE(7,13)IWLL,JJ,ICOL,ELEV,SUM1,THICK
   13 FORMAT( 'COLOR2 ',3I5,F6.1,2X,F6.1,6X,F6.2)
    4 J=J+1
      IF(SUM2)55,55,54
   54 WRITE(6,103)SUM2
   55 IF(SUM3)5,5,56
   56 WRITE(6,104)SUM3
    5 CONTINUE
    6 CONTINUE
      RETURN
      END
C
C
      SUBROUTINE SERCH(NLAY,GSELV,IC)
C     SUBROUTINE READS FROM DISC (1) TOTAL NO. OF LAYERS, (2) GROUND
C     SURFACE ELEVATION FOR SELECTED TEST HOLE
      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
      COMMON ISEC,ISEC1,ISEC2
C     SET SECTOR NUMBER TO READ TOTAL NO. OF LAYERS FROM DISC
      IBRN=0
      ISEC=21
 3001 READ(2'ISEC)WVAR
      IKKK=IWELL(IC)
      IF(IBRN)10,10,3002
   10 NLAY=WVAR(IKKK)
C     SET SECTOR NUMBER TO READ GROUND SURFACE ELEV. FROM DISC
      ISEC=6
      IBRN=1
      GO TO 3001
C     SETS GSELV TO GROUND SURFACE ELEVATION
 3002 GSELV=WVAR(IKKK)
      RETURN
      END
C
```

```
C
      SUBROUTINE MATRL (ICOND,NWELL,MAJTS,IPUNH)
C     SUBROUTINE SELECTS MAJOR AND MINOR MATERIAL TYPE OF
C     LITHOLOGY
      DIMENSION MAJTS (10)
      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
      COMMON ISEC,ISEC1,ISEC2
  100 FORMAT(' ', 'HOLE NO.',2X,'LAYER NO',2X,'MAJOR TYPE',3X, 'MINOR TY
     1PE',5X,'ELEV',4X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR)  NET
     2THICK(MINOR)')
  101 FORMAT(' ',2X,I3,8X,I2,10X,I5,18X,F6.1,2X,F6.1,6X,F6.2)
  102 FORMAT(' ',2X,I3,8X,I2,22X,I5,6X,F6.1,2X,F6.1,6X,F6.2)
  103 FORMAT('+',80X,F6.2)
  104 FORMAT('+',99X,F6.2)
      WRITE(6,100)
C     ICOND IS THE NUMBER OF MATERIAL TYPES SELECTED.
      DO 6 K=1,ICOND
C     SETS JTEST EQUAL TO MATERIAL CODE SELECTED (2 DIGIT)
      JTEST=MAJTS(K)
C     SEARCH THROUGH EACH SELECTED TEST HOLE
      DO 5 IC=1,NWELL
C     CALLS SUBROUTINE SERCH
      CALL SERCH (NLAY,GSELV,IC)
      ISEC2=IWELL(IC)
C     READ LAYER DATA FROM DISC FOR EACH HOLE
      READ (1'ISEC2)STRAT
      SUM=0.0
      J=1
      SUM2=0.0
      SUM3=0.0
   52 IWLL=IWELL(IC)
C     SEARCH ALL LAYERS IN EACH HOLE
   53 DO 4 JJ=1,NLAY
C     SET TYPE EQUAL TO MATERIAL CODE FOR EACH LAYER (5 DIGIT)
   50 TYPE=STRAT(J,3)
C     SUM IS THE TOTAL THICKNESS INCLUDING THE LAYER BEING SEARCHED
      SUM=SUM+STRAT(J,2)
C     SETS KTEST TO A TWO DIGIT CODE OF MAJOR MATERIAL TYPE
      KTEST=IFIX(TYPE)/1000
C     THICK IS THE THICKNESS OF LAYER BEING SEARCHED
      THICK=STRAT(J,2)
C     TEST IF MAJOR MATERIAL TYPE IS IN SELECTED LAYER
      ID1=TYPE/10000.
      IF(ID1-2)1002,30,1002
   30 ITYPE=TYPE/1000.
      ID2=ITYPE-(ITYPE/10*10)
      IF(ID2-2)34,31,34
   31 ITEST=ID2+10
 1000 IF(ITEST-JTEST)32,1,32
   32 ITYPE=TYPE/10.
      ID4=ITYPE-(ITYPE/10*10)
 1001 IF(ID4-2)35,33,35
   33 ITEST=ID4+10
      IF(ITEST-JTEST)4,1,4
   34 ITYPE=TYPE/100.
      ID23=ITYPE-(ITYPE/100*100)
      IF(ID23-JTEST)1001,1,1001
   35 ITYPE=TYPE
      ITEST=ITYPE-(ITYPE/100*100)
      IF(ITEST-JTEST)4,1,4
 1002 IF(KTEST-JTEST)2,1,2
C     SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MAJOR TYPE IS FOUND
    1 SUM1=SUM-STRAT(J,2)
C     SUM2 IS THE TOTAL THICKNESS OF LAYERS WITH MAJOR TYPE
      SUM2=SUM2+THICK
C     ELEV IS ELEVATION OF TOP OF LAYER CONTAINING MAJOR TYPE
      ELEV=GSELV-SUM1
C     SETS TYPE TO AN INTEGER NUMBER
      ITYPE=TYPE
C     LABELS HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF
```

```
C     LAYER, DEPTH TO LAYER, LAYER THICKNESS
      WRITE(6,101) IWLL,      JJ,ITYPE,ELEV,SUM1,THICK
C     TEST FOR PUNCHED OUTPUT
      IF(IPUNH)4,4,7
C     PUNCHES HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF
C     LAYER, DEPTH TO LAYER, LAY THICK
    7 WRITE(7,8)IWLL,JJ,ITYPE,ELEV,SUM1,THICK
    8 FORMAT('MAJOR',3I6,2F8.1,F10.2)
      GO TO 4
C     BREAK DOWN TYPE OF MATERIAL CODE TO TWO DIGITS
    2 INUM=TYPE/1000.
      ITYPE=TYPE
C     BREAK DOWN TYPE OF MATERIAL CODE TO MINOR TYPE ONLY
C     TEST IF MINOR TYPE OF MATERIAL CODE CALLED IS IN LAYER
      INUM=TYPE-(FLOAT(INUM)*1000.)
      IADJ=INUM/100
      IF(IADJ-1)21,20,21
   20 KTEST=INUM/10
      GO TO 22
   21 KTEST=INUM-(IADJ*100)
   22 IF(KTEST-JTEST)4,3,4
C     SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MINOR TYPE CODE IS FOUND
    3 SUM1=SUM-STRAT(J,2)
      SUM3=SUM3+THICK
C     ELEV IS THE ELEVATION OF TOP OF LAYER WHERE MINOR TYPE IS FOUND
      ELEV=GSELV-SUM1
C     LABELS WELL NO., LAYER NO., MINOR MATERIAL TYPE, ELEV OF TOP OF
C     LAYER, LAYER THICK
      WRITE(6,102) IWLL,      JJ,ITYPE,ELEV,SUM1,THICK
      IF(IPUNH)4,4,9
    9 WRITE(7,10)IWLL,JJ,ITYPE,ELEV,SUM1,THICK
   10 FORMAT('MINOR',3I6,2F8.1,F10.2)
    4 J=J+1
C     TEST IF NET THICKNESS OF LAYERS WITH MAJOR MATERIAL IS SELECTED
      IF(SUM2)55,55,54
C     WRITE NET THICKNESS OF LAYERS WITH MAJOR MATERIAL TYPE
   54 WRITE(6,103)SUM2
   55 IF(SUM3)5,5,56
   56 WRITE(6,104)SUM3
    5 CONTINUE
    6 CONTINUE
      RETURN
      END
C
C
      SUBROUTINE TAPES
C     SUBROUTINE TAPES READS TAPES USED IN STORAGE AND RETRIEVAL PROGRAM
C     TAPE NUMBER 8 FOR WELL VARIABLE DATA.
C     TAPE DRIVE NUMBER 9 FOR LAYER DATA.
      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
      COMMON ISEC,ISEC1,ISEC2
      ISEC1=1
      DO 10 I=1,21
C     READS TEST HOLE DATA VARIABLES FROM TAPE
      READ(8,END=11)WVAR
C     WRITES TEST HOLE DATA ON DISC FILE
   10 WRITE(2'ISEC1)WVAR
   11 DO 20 J=1,1000
C     READS LAYER DATA VARIABLES FROM TAPE
      READ(9,END=30)IM,I,STRAT
C     SELECTS LAYER VARIABLES FOR SPECIFIED TEST HOLES
      IF(IM)30,30,20
C     WRITE(LAYER DATA ON DISC)
   20 WRITE(1'IM)STRAT
   30 RETURN
      END
C
C
C     SUBROUTINE JULDY COMPUTES JULIAN DATE FROM CALENDAR DATE AND MILITARY
C     TIME.
```

```
      SUBROUTINE JULDY (IMO,IDY,IYR,IHR,TIME)
      NYR=IYR/4
      NYR=NYR*4
      IF (NYR-IYR) 2,1,2
    1 IB=1
      GO TO 3
    2 IB=2
    3 JDAY=0
      DO 10 I=1,IMO
      GO TO (4,5,6,5,9,5,9,5,5,9,5,9),I
    4 MO=0
      GO TO 10
    5 MO=31
      GO TO 10
    6 GO TO (7,8),IB
    7 MO=29
      GO TO 10
    8 MO=28
      GO TO 10
    9 MO=30
   10 JDAY=JDAY+MO
      JDAY=JDAY+IDY
      DAY=JDAY-1
      DAY=DAY*1440.
      HR=(IHR/100)*60
      HR1=IHR-((IHR/100)*100)
      TIME=DAY+HR+HR1
  102 RETURN
      END
C
C
C     SUBROUTINE WATLV COMPUTES GROUND WATER ELEVATION AT SELECTED TEST HOLES
C     WHEN DATA FROM THE SATURATED ZONE IS RETRIEVED
      SUBROUTINE WATLV(NWELLS,IWELL,WATEL)
C     WATER LEVEL PROGRAM COMPUTES AVERAGE GROUND WATER ELEVATION FOR A SELECTED
C     TIME PERIOD.
      DIMENSION IWELL(1000),WATEL(1000)
      REWIND 4
      JWELL1=0
C     BEGINNING (IMO, IDY, IYR, ITIM) AND ENDING (JMO, JDY, JYR, JTIM) MONTH,
C     DAY, YEAR, MILITARY TIME OF PERIOD FOR WHICH AVERAGE WATER LEVEL IS
C     COMPUTED IS READ FROM DATA CARD
    1 READ(5,101)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
  101 FORMAT(16I5)
      WRITE(6,110)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
  110 FORMAT('0',25('*'),'TIME PERIOD FOR SEASONAL ',I2,'/',I2,'/',I2,'/
     1',I4,' TO ',I2,'/',I2,'/',I2,'/',I4,1X,25('*'),//)
      IIYR=IYR
      IF(IMO)107,107,5
C     SUBROUTINE JULDY COMPUTES TIME IN MINUTES FROM MONTH, DAY, YEAR, AND
C     MILITARY TIME
C     BTIM-BEGINNING TIME (JULIAN DATE IN MINUTES) OF PERIOD FOR WHICH WATER
C          LEVELS ARE AVERAGED
    5 CALL JULDY(IMO,IDY,IYR,ITIM,BTIM)
      IF(IYR-JYR)2,3,3
C     EYEAR-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED CROSSES END OF YEAR
C            THEN EYEAR (END OF FIRST YEAR, JULIAN DATE IN MINUTES) IS CALUCLATED
    2 CALL JULDY(12,31,IYR,2359,EYEAR)
  500 IIYR=IIYR+1
      IF(IIYR-JYR)501,502,502
C     STIME-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED SPANS A FULL YEAR
C            THAT YEARS TIME (JULIAN DATE IN MINUTES) IS CALCULATED
  501 CALL JULDY(12,31,IIYR,2359,STIME)
      EYEAR=EYEAR+STIME
      GO TO 500
C     EETIM-THE JULIAN DATE IN MINUTES FROM JANURARY 1 OF THE FINAL YEAR TO THE
C     END OF THE SELECTED TIME PERIOD
  502 CALL JULDY(JMO,JDY,JYR,JTIM,EETIM)
      ETIME=EETIM
      ETIM=EETIM+EYEAR
      GO TO 6
```

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C     ETIM-END OF SELECTED PERIOD (JULIAN DATE IN MINUTES)
    3 CALL JULDY(JMO,JDY,JYR,JTIM,ETIM)
      ETIME=ETIM
C     TTIM-TOTAL TIME (MINUTES) OF SELECTED TIME PERIOD
    6 TTIM=ETIM-BTIM
C     RATE OF WATER LEVEL CHANGE IS COMPUTED FROM ELEVATIONS READ FROM TAPE
C     WITHIN THE SELECTED TIME PERIOD.
      DO 1110 I=1,NWELLS
      IF(IWELL(I)-JWELL1)7,1000,8
    7 REWIND 4
      JWELL1=0
    8 KKK=IWELL(I)
      JBRN=1
      JBN=1
      STIM=0.0
      SGH=0.0
      TIMZ=0.0
      TM=0.0
   10 READ(4,END=107) NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV
      IF(NWELL-IWELL(I))10,20,85
   20 CALL JULDY(NMO,NDY,NYR,NTIM,TIME)
      GO TO(3000,3001),JBRN
 3000 JBRN=2
      IF(IYR-NYR)86,30,3010
 3001 IF(IYR-NYR)40,30,3010
   30 IF(BTIM-TIME)3003,3002,3010
 3002 WGH=0.0
      ELEV2=ELEV
      TIMEB=TIME
      GO TO 3011
 3003 IF(NYR1-NYR)3005,3004,3004
 3004 JBN=2
      GO TO 40
 3005 JBN=3
      GO TO 40
 3010 NYR1=NYR
      GO TO 10
   40 BACKSPACE 4
      BACKSPACE 4
      READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
      CALL JULDY(NMO,NDY,NYR,NTIM,TIMA)
   45 READ(4,END=107)KWELL,KCODE,KYR,KMO,KDY,KTIM,ELEV2
      IF(KWELL-IWELL(I))86,46,87
   46 IF((KYR-NYR)-1)3014,3013,3012
C     A BREAK IN RECORD GREATER THAN ONE YEAR IS PRINTED IN OUTPUT
 3012 WRITE(6,109)IWELL(I),NMO,NDY,NYR,NTIM,KMO,KDY,KYR,KTIM
  109 FORMAT(' WELL NUMBER ',I4,' BREAK IN RECORD FROM ',3I3,I5,' TO ',
     13I3,I5)
      GO TO 1005
 3013 IF(KMO+(12-NMO)-12)3014,3012,3012
 3014 CALL JULDY(KMO,KDY,KYR,KTIM,TIMEB)
      GO TO(206,207,3006),JBN
 3006 CALL JULDY(12,31,NYR,2359,TM)
      DIFF=((TM-TIMA)+BTIM)+(TIMEB-BTIM)
      DIFF1=TIMEB-BTIM
      GO TO 208
  206 CALL JULDY(12,31,NYR,2359,TM)
      DIFF=(TM-TIMA)+TIMEB
      DIFF1=(TM-BTIM)+TIMEB
      GO TO 208
  207 DIFF=TIMEB-TIMA
      DIFF1=TIMEB-BTIM
  208 SLOPE=(ELEV2-ELEV1)/DIFF
      GHA=ELEV2-(SLOPE*DIFF1)
      DIFF=DIFF1
      STIM=STIM+DIFF
      IF(STIM-TTIM)1002,1011,1010
 1010 DIFF=DIFF-(TM-ETIM+TIMEB)
      GHB=ELEV2-SLOPE*(TM-ETIM+TIMEB)
      GO TO 1012
 1011 GHB=ELEV2-SLOPE*(TIMEB-ETIM)
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```
 1012 WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
      GO TO 9001
 1002 GHB=ELEV2
      WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
 3011 SGH=SGH+WGH
      GHA=ELEV2
      TIMZ=TIMEB
   50 READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,GHB
      IF(NWELL-IWELL(I))86,51,87
   51 CALL JULDY(NMO,NDY,NYR,NTIM,TIMX)
      IF(TIMZ-TIMX)201,201,200
  200 CALL JULDY(12,31,NYR-1,2359,TM)
      DIFF=((TM-TIMZ)+TIMX)
      GO TO 203
  201 DIFF=TIMX-TIMZ
  203 STIM=STIM+DIFF
      IF(STIM-TTIM)55,800,70
   55 WGH=((((GHB+GHA)*.5)*DIFF)/TTIM)
      SGH=SGH+WGH
      GHA=GHB
      TIMZ=TIMX
      GO TO 50
  800 WGH=((((GHB+GHA)*.5)*DIFF)/TTIM)
      GHA=GHB
      TIMZ=TIMX
      GO TO 9001
   70 BACKSPACE 4
   80 BACKSPACE 4
      READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
      IF(NWELL-IWELL(I))86,81,87
   81 GHA=ELEV1
      CALL JULDY(NMO,NDY,NYR,NTIM,TIMEA)
      READ(4,END=107)NWELL,NCODE,NYR1,NMO,NDY,NTIM,ELEV2
      CALL JULDY(NMO,NDY,NYR1,NTIM,TIMEB)
      IF(NYR1-NYR)805,805,801
  801 CALL JULDY(12,31,NYR,2359,TM1)
      DIFF=(TM1-TIMEA)+TIMEB
      SLOPE=(ELEV2-ELEV1)/DIFF
      IF(JYR-NYR)803,803,802
  802 GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
      WGH=((((GHB+GHA)*.5)*((TM1-TIMEA) +ETIME))/TTIM)
      GO TO 9001
  803 GHB=ELEV1+(SLOPE*(ETIME-TIMEA))
      GO TO 9000
  805 SLOPE=(ELEV2-ELEV1)/(TIMEB-TIMEA)
      GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
      IF(ETIME-TIMEA)9000,9009,9000
 9009 ETIME=TIMEB
 9000 WGH=((((GHB+GHA)*.5)*(ETIME-TIMEA))/TTIM)
 9001 WGHP=SGH+WGH
      GO TO 1006
C     WHEN NO RECORD IS FOUND FOR SELECTED TIME PERIOD THIS IS PRINTED IN OUTPUT
   85 WRITE(6,103)IWELL(I),IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
  103 FORMAT(' ',' WELL NO. ',I4,' NO RECORD FOR PERIOD OF ',3I3,I5,' TO
     1 ',3I3,I5)
      GO TO 1005
C     WHEN SELECTED TIME PERIOD STARTS BEFORE RECORDS ON TAPE THIS IS PRINTED IN
C     OUTPUT.
   86 WRITE(6,104)IWELL(I)
  104 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD STARTS BEFORE ACTUAL
     1RECORD')
      GO TO 1005
C     WHEN SELECTED TIME PERIOD GOES BEYOND RECORDS ON TAPE THIS IS PRINTED IN
C     OUTPUT
   87 WRITE(6,105)IWELL(I)
  105 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD BEYOND ACTUAL RECORD
     1')
C     NUMBER 99999 STORED IN WATEL (KKK) INDICATES A MISSING RECORD FOR THESE
C     SELECTED TIME PERIODS
 1005 WGHP=99999.
 1006 WATEL(KKK)=WGHP
```

```
 1000 JWELL1=IWELL(I)
 1110 CONTINUE
  107 RETURN
      END
C
C
C     END OF RETRIEVAL PROGRAMS, STORAGE PROGRAMS FOLLOW.
C
C     **** STORAGE PROGRAM FOR TEST HOLE DATA ****
      DEFINE FILE 1(21,1000,U,IM)
      DIMENSION WELL1(1000),WELL(4),NN(4)
      DIMENSION ISTART(21)
      DO 105 I=1,21
  105 ISTART(I)=0
C     READ FROM CARD THE NUMBER OF TEST HOLE VARIABLES TO BE STORED ON DISC
      READ(5,100) NOVAR
  100 FORMAT(I4)
C     READ A VARIABLE NUMBER, FOUR VARIABLE VALUES, AND FOUR TEST HOLE
C     NUMBERS FROM CARDS
   99 READ(5,200)NVAR,(NN(I),I=1,4),(WELL(I),I=1,4)
  200 FORMAT(I2,4I5,4F11.0)
      IF(NVAR)4,4,1
    1 IM=NVAR
      IF(ISTART(NVAR).EQ.0) GO TO 6
      READ(1'IM) WELL1
      IM=IM-1
      GO TO 8
    6 DO 7 I=1,1000
    7 WELL1(I)=0.
    8 DO 3 I=1,4
      IF(NN(I))3,3,2
    2 IW=NN(I)
      WELL1(IW)=WELL(I)
    3 CONTINUE
C     WRITE TEST HOLE VARIABLE ON DISC
      WRITE(1'IM) WELL1
      ISTART(NVAR)=1
      GO TO 99
C     WRITE TEST HOLE VARIABLE DATA FROM DISC TO TAPE
    4 IM=1
      DO 5 I=1,NOVAR
      READ(1'IM) WELL1
      WRITE(9) WELL1
C     WRITE VARIABLE NUMBER, TEST HOLE NUMBER, AND VARIABLE VALUE ON PRINTER
      WRITE(6,101)I,(J,WELL1(J),J=1,1000)
  101 FORMAT('0','VARIABLE NUMBER',I2,//,7(I4,2X,F11.0))
    5 CONTINUE
      WRITE(6,102)
  102 FORMAT ('1','TEST HOLE VARIABLE DATA HAS BEEN STORED ON TAPE')
      STOP
      END
C
C
C
C     **** STORAGE PROGRAM FOR LAYER DATA ****
      DEFINE FILE 1(1000,161,U,IM)
      DIMENSION STRAT(20,8),NWELLS(1000)
C     NOWEL IS THE NUMBER OF TEST HOLES FOR WHICH DATA IS STORED
      READ(5,100)NOWEL
  100 FORMAT(I4)
      ICOUN=0
      DO 3 IC=1,NOWEL
C     NWELL IS THE TEST HOLE NUMBER
C     STRAT (1,J) IS THE LAYER VARIABLES STORED IN EACH LAYER
C     NOLAY IS THE NUMBER OF THE LAYER FOR WHICH VARIABLES ARE STORED.
      READ(5,101)NWELL,(STRAT(1,J),J=1,8),NOLAY
  101 FORMAT(I4,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6,I4)
      IF(NWELL)200,200,300
  300 ICOUN=ICOUN+1
      IF(NOLAY-1)3,2,1
    1 READ(5,106)((STRAT(I,J),J=1,8),I=2,NOLAY)
```

```
  106 FORMAT(4X,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6)
    2 WRITE(1'NWELL)NOLAY,STRAT
      NWELLS(IC)=NWELL
    3 CONTINUE
C     SEQUENCE THE WELLS IN ASCENDING ORDER
  200 NUM=ICOUN-1
      DO 5 J=1,ICOUN
      DO 5 I=1,NUM
      IF(NWELLS(I)-NWELLS(I+1))5,5,4
    4 HOLD=NWELLS(I)
      NWELLS(I)=NWELLS(I+1)
      NWELLS(I+1)=HOLD
    5 CONTINUE
C     WRITE LAYER DATA ON TAPE AND PRINTER
      DO 7 IC=1,ICOUN
      IM=NWELLS(IC)
      READ(1'IM)NOLAY,STRAT
      IU=IM-1
      WRITE(8) IU,NOLAY,STRAT
      DO 6 I=1,NOLAY
  103 FORMAT(' ',2I5,8F10.1)
    7 CONTINUE
      IM=0
      WRITE(8)IM,NOLAY,STRAT
      WRITE(6,104)
  104 FORMAT('1','LAYER DATA STORED ON TAPE')
      STOP
      END
C
C
C     **** WATER LEVEL DATA STORAGE PROGRAM ****
C     CALLS SUBROUTINE (TESTEL)
C     PROGRAM STORES PUNCH CARD TAPE DOWN DATA AS WATER LEVEL ELEVATIONS ON
C     MAGNETIC TAPE.
C     MASTER TAPE OF WATER LEVEL ELEVATIONS IS CONSTRUCTED USING PIPE ELEVATIONS
C     AND TAPE DOWN DATA STORED ON CARDS OR TAPES.
C     WATER LEVEL DATA FOR SELECTED TEST HOLES CAN BE UPDATED USING THIS
C     PROGRAM.
C     TAPE PARAMETERS READ IN BY DATA STATEMENT
C     WORDS-NUMBER OF WORDS WRITTEN PER RECORD
C     LRECL-LENGTH OF RECORD SIZE
C     BLKSIZ-BLOCK SIZE PARAMETER
C     BPI-BITS PER INCH FOR OUTPUT TAPE
C     RGAP-RECORD GAPE BETWEEN RECORDS (INCHES)
      REAL*4 LRECL,INPBK
      DIMENSION KWL(4),ELVX(4),ELVN(1000),ITEST(1000),JWELL(3)
      DIMENSION IWN(100),IMO(100),IDY(100),IYR(100),ELV(100)
      DIMENSION ITAPE(3),NMO(3),NDY(3),NYR(3),NTIM(3),EL(3)
      COMMON NYR,NMO,NDY,NTIM,EL,IYR,IMO,IDY,ELV,ELVN,ITEST,KTAPE,
     *NCODE,ICOUNT,IPAGE,IWN
      DATA WORDS,LRECL,BLKSIZ,BPI,RGAP/8.,24.,2400.,1600.,.75/
      DATA JWELL/3*0/
      DO 1 I=1,1000
      ITEST(I)=1
    1 ELVN(I)=0.0
C     READ IN TOP OF PIPE ELEVATIONS FOR ALL TEST HOLES.
C     IV-LAST CARD TEST
C     KWL (I)-TEST HOLE NUMBERS.
C     ELVX (I)-TOP OF PIPE ELEVATIONS AT EACH TEST HOLE.
    5 READ(5,1000)IV,(KWL(I),I=1,4),(ELVX(I),I=1,4)
 1000 FORMAT(I2,4I5,4F11.2)
      IF(IV.LE.0) GO TO 15
      DO 10 I=1,4
      IF(KWL(I).LE.0) GO TO 10
      KKK=KWL(I)
      ELVN(KKK)=ELVX(I)
   10 CONTINUE
      GO TO 5
C     READ IN PIPE ELEVATIONS CHANGES
   15 I=1
C     IWN (I)-TEST HOLE NUMBER
```

```
C      IMO (I), IDY (I), IYR (I) IS THE MONTH, DAY, AND YEAR OF PIPE ELEVATION
C      (ELV (I)) CHANGES.
   16 READ(5,1001)IWN(I),IMO(I),IDY(I),IYR(I),ELV(I)
 1001 FORMAT(4I5,F10.2)
      IF(IWN(I).LE.0) GO TO 17
      ITEST(IWN(I))=0
      I=I+1
      GO TO 16
   17 NOBS1=I
C      NTAPE-NUMBER OF TAPE DRIVE UNITS USED.
C      ITAPE (I)-TAPE DRIVE UNIT NUMBERS.
C      KTAPE-CREATED OR UPDATED TAPE UNIT NUMBER.
      READ(5,1002)NTAPE,(ITAPE(I),I=1,NTAPE),KTAPE
 1002 FORMAT(5I5)
C      READ WELL NUMBER FROM TAPES FOR INITILIZATION.
 1005 DO 1006 IT=1,NTAPE
      ITP=ITAPE(IT)
      READ(ITP,103)JWELL(IT)
 1006 CONTINUE
 1007 WRITE(6,9999)(JWELL(I),I=1,NTAPE)
 9999 FORMAT('0***** ',3I10,' *****'/)
C      FOLLOWING TEST STATEMENTS SELECT DATA FROM TWO OR THREE DATA SETS AND
C      ARRANGES THEM IN ORDER OF ASCENDING TEST HOLE NUMBERS FOR CREATING OR
C      UPDATING DATA TAPE.
      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 2000
      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).GT.0)GO TO 1060
      IF(JWELL(1).EQ.0.AND.JWELL(2).GT.0.AND.JWELL(3).EQ.0)GO TO 1050
      IF(JWELL(1).GT.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 1030
      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
      IF(JWELL(1).EQ.0.AND.JWELL(2).LT.JWELL(3)) GO TO 1050
      IF(JWELL(1).EQ.0.AND.JWELL(2).GT.JWELL(3)) GO TO 1060
      IF(JWELL(2).EQ.0.AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
      IF(JWELL(2).EQ.0.AND.JWELL(1).LT.JWELL(3)) GO TO 1030
      IF(JWELL(2).EQ.0.AND.JWELL(1).GT.JWELL(3)) GO TO 1060
      IF(JWELL(3).EQ.0.AND.JWELL(1).EQ.JWELL(2)) GO TO 1010
      IF(JWELL(3).EQ.0.AND.JWELL(1).LT.JWELL(2)) GO TO 1030
      IF(JWELL(3).EQ.0.AND.JWELL(1).GT.JWELL(2)) GO TO 1050
      IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1009
      IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1010
      IF(JWELL(1).LT.JWELL(2).AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1030
      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1050
      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1030
      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1030
      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1050
      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1060
      WRITE(6,1008)
 1008 FORMAT('0','THERE ARE NO TEST COMBINATIONS FOR THESE TEST HOLES.'/)
      GO TO 2000
 1009 DO 34 IT=1,NTAPE
      ITP=ITAPE(IT)
      IF(ITAPE(IT).EQ.0) GO TO 34
      BACKSPACE ITP
      NWELL1=JWELL(ITP)
   20 IF(ITP.EQ.1) GO TO 21
      READ(ITP,103,END=30)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
     1),I=1,3)
      IREAD=3
  103 FORMAT(I4,I2,3(1X,3I2,I5,F7.2))
      GO TO 22
   21 READ(ITP,104,END=30)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
  104 FORMAT(I4,4I2,I4,F8.2)
      IREAD=1
   22 IF(NWELL1.NE.NWELL) GO TO 25
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 20
   25 JWELL(ITP)=NWELL
      GO TO 34
   30 JWELL(ITP)=0
```

```
      ITAPE(IT)=0
   34 CONTINUE
      GO TO 1007
 1010 DO 45 IT=1,2
      ITP=ITAPE(IT)
      IF(ITAPE(IT).EQ.0) GO TO 45
      BACKSPACE ITP
      NWELL1=JWELL(ITP)
   35 IF(ITP.EQ.1) GO TO 36
      READ(ITP,103,END=41)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
     1),I=1,3)
      IREAD=3
      GO TO 37
   36 READ(ITP,104,END=41)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
      IREAD=1
   37 IF(NWELL1.NE.NWELL) GO TO 40
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 35
   40 JWELL(ITP)=NWELL
      GO TO 45
   41 JWELL(ITP)=0
      ITAPE(IT)=0
   45 CONTINUE
      GO TO 1007
 1020 DO 65 IT=1,2
      GO TO (50,51),IT
   50 ITP=ITAPE(1)
      IF(ITAPE(1).EQ.0)GO TO 65
      GO TO 52
   51 ITP=ITAPE(3)
      IF(ITAPE(3).EQ.0)GO TO 65
   52 BACKSPACE ITP
      NWELL1=JWELL(ITP)
   55 IF(ITP.EQ.1) GO TO 56
      READ(ITP,103,END=61)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
     1),I=1,3)
      IREAD=3
      GO TO 57
   56 READ(ITP,104,END=61)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
      IREAD=1
   57 IF(NWELL1.NE.NWELL) GO TO 60
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 55
   60 JWELL(ITP)=NWELL
      GO TO 65
   61 JWELL(ITP)=0
      ITAPE(ITP)=0
   65 CONTINUE
      GO TO 1007
 1030 ITP=ITAPE(1)
      IF(ITAPE(1).EQ.0) GO TO 1007
      BACKSPACE ITP
      NWELL1=JWELL(ITP)
   70 IF(ITP.EQ.1) GO TO 71
      READ(ITP,103,END=80)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
     1),I=1,3)
      IREAD=3
      GO TO 72
   71 READ(ITP,104,END=80)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
      IREAD=1
   72 IF(NWELL1.NE.NWELL) GO TO 75
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 70
   75 JWELL(ITP)=NWELL
      GO TO 1007
   80 JWELL(ITP)=0
      ITAPE(1)=0
      GO TO 1007
```

```
 1040 DO 100 IT=1,2
      GO TO(85,86),IT
   85 ITP=ITAPE(2)
      IF(ITAPE(2).EQ.0)GO TO 100
      GO TO 87
   86 ITP=ITAPE(3)
      IF(ITAPE(3).EQ.0)GO TO 100
   87 BACKSPACE ITP
      NWELL1=JWELL(ITP)
   90 IF(ITP.EQ.1) GO TO 91
      READ(ITP,103,END=96)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
     1),I=1,3)
      IREAD=3
      GO TO 92
   91 READ(ITP,104,END=96)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
      IREAD=1
   92 IF(NWELL1.NE.NWELL) GO TO 95
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 90
   95 JWELL(ITP)=NWELL
      GO TO 100
   96 JWELL(ITP)=0
      ITAPE(ITP)=0
  100 CONTINUE
      GO TO 1007
 1050 ITP=ITAPE(2)
      IF(ITAPE(2).EQ.0)GO TO 115
      BACKSPACE ITP
      NWELL1=JWELL(ITP)
  105 IF(ITP.EQ.1) GO TO 106
      READ(ITP,103,END=111)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(
     1I),I=1,3)
      IREAD=3
      GO TO 107
  106 READ(ITP,104,END=111)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
     *)
      IREAD=1
  107 IF(NWELL1.NE.NWELL) GO TO 110
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 105
  110 JWELL(ITP)=NWELL
      GO TO 115
  111 JWELL(ITP)=0
      ITAPE(ITP)=0
  115 CONTINUE
      GO TO 1007
 1060 ITP=ITAPE(3)
      IF(ITAPE(3).EQ.0)GO TO 130
      BACKSPACE ITP
      NWELL1=JWELL(ITP)
  120 IF(ITP.EQ.1) GO TO 121
      READ(ITP,103,END=126)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(
     1I),I=1,3)
      IREAD=3
      GO TO 122
  121 READ(ITP,104,END=126)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
     *)
      IREAD=1
  122 IF(NWELL1.NE.NWELL) GO TO 125
      CALL TESTEL(NWELL,NOBS1,IREAD)
      NWELL1=NWELL
      GO TO 120
  125 JWELL(ITP)=NWELL
      GO TO 130
  126 JWELL(ITP)=0
      ITAPE(ITP)=0
  130 CONTINUE
      GO TO 1007
C     COMPUTES THE NUMBER OF FEET OF TAPE USED TO STORE WATER LEVEL ELEVATIONS
```

```
C     AND THE NUMBER OF RECORDS STORED.
 2000 RECD=ICOUNT
      RECDS=BLKSIZ/LRECL
      INPBK=((WORDS*BLKSIZ)/BPI)+RGAP
      FT=((RECD/RECDS)*INPBK)/12.
      WRITE(6,2001) ICOUNT,KTAPE,FT
 2001 FORMAT('0','$$$$$  ',I7,' NUMBER OF OBSERVATIONS WRITTEN ON TAPE ',I2,
     *'  $$$$$'/,6X,'FEET USED TO STORE DATA ON THIS TAPE IS ',F6.1)
      REWIND KTAPE
      STOP
      END
C
C
C     SUBROUTINE TESTEL CALCULATES WATER LEVEL ELEVATIONS AND WRITES ON UPDATED
C     TAPE.
      SUBROUTINE TESTEL(NWELL,NOBS1,IREAD)
      COMMON NYR(3),NMO(3),NDY(3),NTIM(3),EL(3),IYR(100),IMO(100),IDY(10
     10),ELV(100),ELVN(1000),ITEST(1000),KTAPE,NCODE,ICOUNT,IPAGE,IWN(10
     10)
      DO 28 I=1,IREAD
      IF(IREAD.EQ.1) GO TO 1000
      IF(NYR(I).EQ.0) GO TO 28
      IF(ITEST(NWELL).EQ.1) GO TO 27
      DO 25 J=1,NOBS1
C     TEST FOR PIPE ELEVATION CHANGE
      IF(NYR(I).GE.IYR(J).AND.NMO(I).GE.IMO(J).AND.NDY(I).GE.IDY(J).AND.
     1NWELL.EQ.IWN(J)) GO TO 26
   25 CONTINUE
      GO TO 27
C     NEW PIPE ELEVATION
   26 ELVN(NWELL)=ELV(J)
      ITEST(NWELL)=1
C     WATER LEVEL ELEVATION CALCULATED.
   27 EL(I)=ELVN(NWELL)-EL(I)
C     OUTPUT WRITTEN ON UPDATED TAPE
 1000 WRITE(KTAPE,104)NWELL,NCODE,NMO(I),NDY(I),NYR(I),NTIM(I),EL(I)
  104 FORMAT(I4,4I2,I4,F8.2)
   28 CONTINUE
      RETURN
      END
C                   END APPENDIX C
```

APPENDIX D.–SOURCE LISTING FOR HYDRAULIC-COEFFICIENT RANGE-ASSIGNMENT PROGRAM

```
C                                       APPENDIX D
C
C
C                         HYDRAULIC COEFFICIENT RANGE ASSIGNMENT PROGRAM
C        ***THIS PROGRAM ASSIGNS HYDRAULIC COEFFICIENT RANGE TO EACH LAYER***
C        THIS PROGRAM REQUIRES A SCRATCH TAPE FOR ASSIGNING CODE VALUES TO LAYER
C        DATA
         DIMENSION A1(35),A2(15),A3(10),A4(15),STRAT(20,8),A5(15)
C        **THE FOLLOWING CARD READS IN THE NUMBER OF MATERIAL TYPES IN EACH RANGE**
         READ(5,200)INO,JNO,KNO,LNO,MNO
     200 FORMAT(5I5)
C      ***THE FOLLOWING CARD PUTS RANGE 1 MATERIAL INTO AN ARRAY FOR LOADING***
         READ(5,101)(A1(I),I=1,INO)
C      ***THE FOLLOWING CARD PUTS RANGE 2 MATERIAL INTO AN ARRAY FOR LOADING***
         READ(5,101)(A2(I),I=1,JNO)
C      ***THE FOLLOWING CARD PUTS RANGE 3 MATERIAL INTO AN ARRAY FOR LOADING***
         READ(5,101)(A3(I),I=1,KNO)
C      ***THE FOLLOWING CARD PUTS RANGE 4 MATERIAL INTO AN ARRAY FOR LOADING***
         READ(5,101)(A4(I),I=1,LNO)
C      ***THE FOLLOWING CARD PUTS RANGE 5 MATERIAL INTO AN ARRAY FOR LOADING***
         READ(5,101)(A5(I),I=1,MNO)
     101 FORMAT(10F8.0)
C      ***THE FOLLOWING CARD READS THE TEST HOLE NO., NO. OF LAYERS AND MATERIAL
C        TYPE***
      10 READ(8,END=1001)NWELL,NOLAY,STRAT
         DO 1000 I=1,20
         IF (NOLAY.EQ.0)GO TO 1002
C      ***THIS SERIES OF TESTS MATCHES MATERIAL TYPE TO THOSE IN EACH RANGE***
C      ***WHEN MATERIAL TYPES MATCH THE RANGE IS ASSIGNED AND STORED ON TAPE***
         DO 20 J=1,INO
         IF(STRAT(I,3)-A1(J)) 20,60,20
      20 CONTINUE
         DO 30 J=1,JNO
         IF(STRAT(I,3)-A2(J)) 30,70,30
      30 CONTINUE
         DO 40 J=1,KNO
         IF(STRAT(I,3)-A3(J)) 40,80,40
      40 CONTINUE
         DO 50 J=1,LNO
         IF(STRAT(I,3)-A4(J))50,90,50
      50 CONTINUE
         DO 500 J=1,MNO
         IF(STRAT(I,3)-A5(J))500,501,500
     500 CONTINUE
         GO TO 1000
C        CODE 1.0, 2.0, 3.0, 4.0, OR 5.0 IS ASSIGNED TO
C        RANGE 1.0, 2.0, 3.0, 4.0, OR 5.0 RESPECTIVELY
C        RANGE CRITERIA IS DETAILED IN TEXT
      60 CODE=1.0
         GO TO 100
      70 CODE=2.0
         GO TO 100
      80 CODE=3.0
         GO TO 100
      90 CODE=4.0
         GO TO 100
     501 CODE=5.0
     100 DO 110 K=6,8
     110 STRAT(I,K)=CODE
    1000 CONTINUE
    1002 WRITE(9)NWELL,NOLAY,STRAT
         GO TO 10
    1001 REWIND 8
         ENDFILE 9
```

```
      REWIND 9
 1004 READ(9,END=1003)NWELL,NOLAY,STRAT
      WRITE(8)NWELL,NOLAY,STRAT
      GO TO 1004
 1003 REWIND 8
      WRITE(6,1005)
C  ***THE FOLLOWING STATEMENT INDICATES RANGES HAVE BEEN STORED ON TAPE***
 1005 FORMAT('ODATA ON TAPE')
      STOP
      END
C                    END APPENDIX D
```

APPENDIX E.—FLOW CHARTS AND LIST OF VARIABLES FOR PREPARING GRAPHICAL PRESENTATIONS

Flow Charts

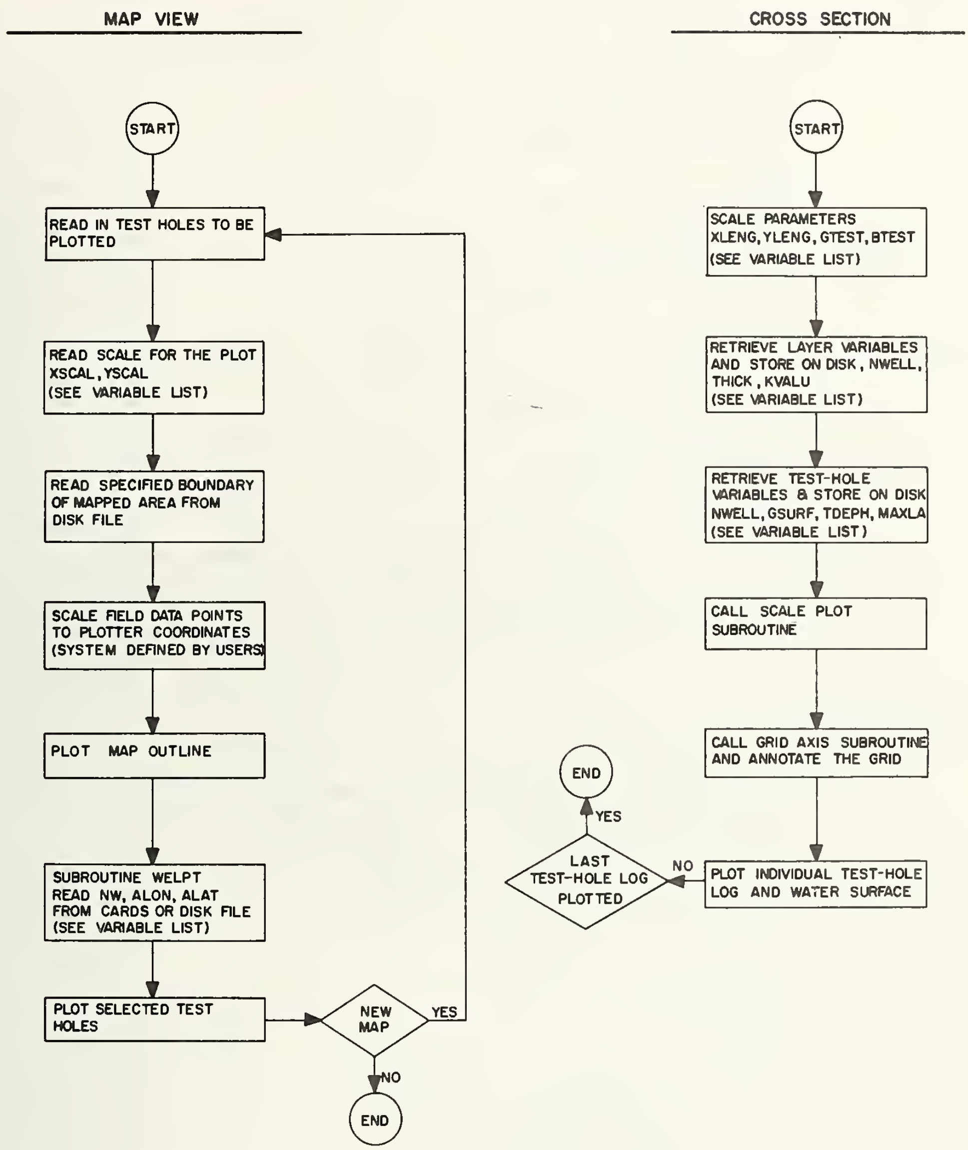

FIGURE E-1.—Flow charts for preparing map views and cross sections.

List of Variables

Variable name	Format	Description of variable
		Boundary Card for Cross Section
XLENG	F10.0	Distance in inches between test-hole-log plots.
YLENG	F10.0	Length in inches of the cross-section plot.
GTEST	F10.0	Reference ground-surface datum from which logs are measured on the plot.
BTEST	F10.0	Lower reference bedrock datum beneath which test-hole logs do not extend.
		Lithology Card for Cross Section
NWELL	I4	Test-hole numbers of logs used in cross section.
IVAR	I4	Layer number for lithology of test holes in cross sections.
THICK	F9.1	Thickness of lithologic layers in feet.
KVALU	F9.1	Hydraulic-coefficient range (1–5) of the lithology in each layer.
		Test-Hole Card for Cross Section
NWELL	I8	Test-hole number for each log in cross section.
GSURF	F12.3	Ground-surface elevation (feet above mean sea level) for the top of each log.
TDEPH	F12.3	Total depth of each test hole.
MAXLA	I2	Number of lithology layers in each test hole in cross section.
		Ground-Water-Elevation Card for Cross Section
HWELL	I5	Test-hole number.
HCODE	I2	Code indicating the method of measurement of ground-water level (1=continuous recorder, 2=manual tape down).
NYR	I3	Year when water surface was recorded.
NMO	I3	Month when water surface was recorded.
NDY	I3	Day when water surface was recorded.
NTIM	I5	Time (military) when water surface was recorded.
ELEV	F8.2	Ground-water-surface elevation (feet above mean sea level) in the test hole. One card per test hole.

Variable name	Format	Description of variable
		Location Card for Map Views
		Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.
NW	F12.3	Test-hole number for each hole plotted in map view.
ALON	F12.3	Longitude in degrees, minutes, seconds of test-hole locations.
ALAT	F12.3	Latitude in degrees, minutes, seconds of test-hole locations.
		Lithology Card for Subdatum Map
NW	I3	Test-hole number of each test hole that penetrates the specific datum plane.
ISUB	I5	Elevation of the datum plane to be plotted (feet above mean sea level).
IDEPH	I4	Depth below ground surface to the top of the lithologic layer in which specified datum plane lies.
ELTOP	F8.2	Elevation of the top of the lithology layer that contains the specified datum plane (feet above mean sea level).
RANGE	F12.4	Range of hydraulic coefficients (1–5) at the specified datum.
THICK	F12.4	Thickness in feet of the lithology layer found at the specified datum.
DAPLT	F12.4	This variable name is assigned to the range of *K*, *S*, or *T* to be plotted.
		Test-Hole Card for Map View
		Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.
NW	I5	Test-hole number.
THVAR	F5.0	Variable THVAR may be any of the 21 test-hole variables used for plotting.
		Net-Thickness Card for Isopachous Map
WELL NO.	A10	Descriptive literal field.
NW	I6	Test-hole number.
NET THICK	A10	Descriptive literal field.
THICK	F13.0	Net thickness in feet of lithologic layers having the selected hydraulic-coefficient ranges.

Variable name	Format	Description of variable
Net-thickness Card for Isopachous Map—Continued		
CODES	A6	Descriptive literal field.
CODE (I)	5F4.0	Number (1–5) of the ranges of hydraulic coefficients, that is, *K*, *S*, or *T*, to be plotted.
Card for Hydraulic-Coefficient Map		
NW	I4	Test-hole number.
Card for Hydraulic-Coefficient Map—Continued		
AKVAL	F5.0	Permeability averaged for all layers in the test hole, gpd/ft^2 of aquifer. The size of the fields containing hydraulic coefficients may be altered to accommodate retrieved data.
ASVAL	F5.0	Storage coefficient, dimensionless value.
ATVAL	F11.0	Transmissibility, gpd/ft of aquifer.

BOUNDARY CARD FOR CROSS SECTION

VARIABLE / TYPE PLOT	COLUMN	XLENG 1-10	YLENG 11-20	GTEST 21-30	BTEST 31-40
CROSS SECTION		X	X	X	X
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

TEST-HOLE CARD FOR CROSS SECTION

VARIABLE / TYPE PLOT	COLUMN	NWELL 1-8	GSURF 13-24	TDEPH 25-36	MAXLA 44-45
CROSS SECTION		X	X	X	X
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

LITHOLOGY CARD FOR CROSS SECTION

VARIABLE / TYPE PLOT	COLUMN	NWELL 1-4	IVAR(1) 5-8	THICK 9-18	KVALU 19-23
CROSS SECTION		X	X	X	X
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

GROUND-WATER-ELEVATION CARD FOR CROSS SECTION

VARIABLE / TYPE PLOT	COLUMN	NWELL 1-5	NCODE 6-7	NYR 8-10	NMO 11-13	NDY 14-16	NTIM 17-21	ELEV 22-29
CROSS SECTION		X	X	X	X	X	X	X
DISTRIBUTIVE MAP								
SUBDATUM MAP								
HYDR.-COEF. MAP								
ISOPACHOUS MAP								

GROUND-WATER ELEVATIONS IN EXAMPLE PLOT WERE RETRIEVED FROM MAGNETIC TAPE STORAGE FOR USE AS CARD INPUT TO PLOTTER PROGRAMS

BLANK CARD FOR CROSS SECTION

VARIABLE / TYPE PLOT	COLUMN
CROSS SECTION	
DISTRIBUTIVE MAP	
SUBDATUM MAP	
HYDR. COEF. MAP	
ISOPACHOUS MAP	

USED IN CROSS-SECTION PLOT ONLY

BLANK CARD INDICATES END OF LITHOLOGIC DATA AND START OF TEST-HOLE DATA

FIGURE F–1.—Input cards for plotting cross sections.

LOCATION CARD FOR MAP VIEW

VARIABLE / TYPE PLOT — COLUMN	ISTOR(1) WEST HOLE NW 1-12	ISTOR(4) LONGITUDE ALON 13-24	ISTOR(3) LATITUDE ALAT 25-36
CROSS SECTION			
DISTRIBUTIVE MAP	X	X	X
SUBDATUM MAP	X	X	X
HYDR.-COEF. MAP	X	X	X
ISOPACHOUS MAP			

CARD CONTAINS TEST-HOLE-NUMBER LONGITUDE AND LATITUDE OF EACH DATA POINT

NET-THICKNESS CARD

VARIABLE / TYPE PLOT — COLUMN	1-10 WELL NO.	NW 11-16	17-26 NET THICK	THICK 27-39	40-45 CODES	46-51	CODE(1) 52-55	CODE(2) 56-59	CODE(3) 60-63	CODE(4) 64-67	CODE(5) 68-71	
CROSS SECTION												
DISTRIBUTIVE MAP												
SUBDATUM MAP												
HYDR.-COEF. MAP												
ISOPACHOUS MAP	X	X	X	X	X	X	X	X	X	X	X	

RANGES 1., 2., 3., 4., AND 5. APE USED IN THIS EXAMPLE

LITHOLOGY CARD FOR SUBDATUM MAP

VARIABLE / TYPE PLOT — COLUMN	NW 1-3	ISUB 4-8	IDEPH 9-12	ELTOP 13-20	RANGE 21-32	THICK 33-44	DAPLT 45-56
CROSS SECTION							
DISTRIBUTIVE MAP							
SUBDATUM MAP	X	X	X	X	X	X	X
HYDR.-COEF. MAP							
ISOPACHOUS MAP							

HYDRAULIC-COEFFICIENT CARD

VARIABLE / TYPE PLOT — COLUMN	NW 1-4	AKVAL 5-9	ASVAL 10-14	ATVAL 15-25
CROSS SECTION				
DISTRIBUTIVE MAP				
SUBDATUM MAP				
HYDR.-COEF. MAP	X	X	X	
ISOPACHOUS MAP				

FIELDS ON THIS CARD MAY BE VARIED TO FIT DATA ATVAL NOT USED IN THE SAMPLE

TEST-HOLE CARD FOR MAP VIEW

VARIABLE / TYPE PLOT — COLUMN	ISTOR(1) TEST HOLE 1-5	ISTOR(I) 6-10
CROSS SECTION		
DISTRIBUTIVE MAP	X	X
SUBDATUM MAP	X	X
HYDR.- COEF. MAP	X	X
ISOPACHOUS MAP		

THE VARIABLE ISTOR(I) MAY BE ANY OF THE 21 TEST-HOLE VARIABLES DESCRIBED PREVIOUSLY

FIGURE F-2.—Input cards for plotting map views.

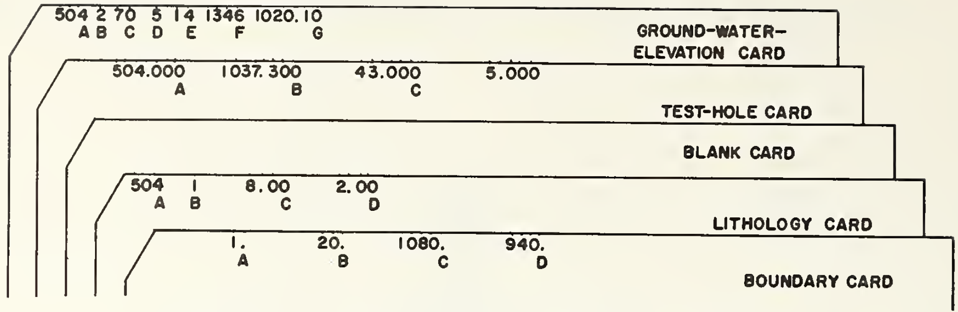

FIGURE F-3.—Input-card setup for plotting cross sections.

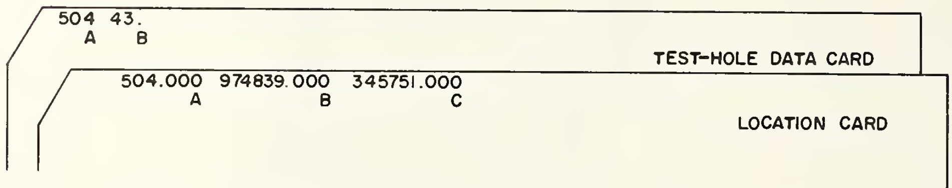

FIGURE F-4.—Input-card setup for plotting test-hole data (see figure 10).

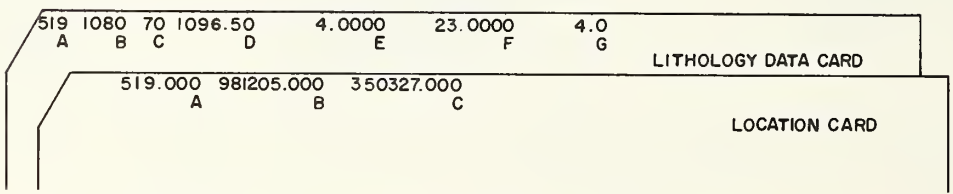

FIGURE F-5.—Input-card setup for plotting data at a specified subdatum (see figure 12).

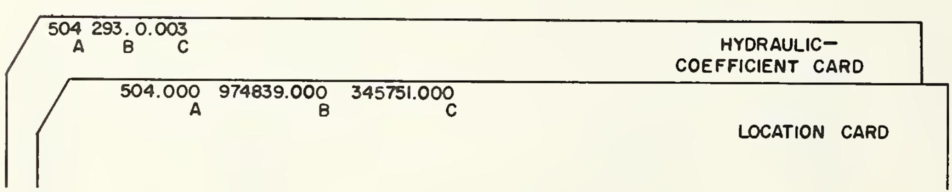

FIGURE F-6.—Input-card setup for plotting average permeability coefficients (see figure 14).

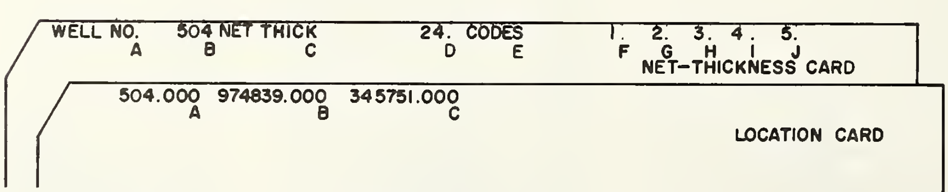

FIGURE F-7.—Input card setup for isopachous maps (see figure 16).

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